UNITED STATES ATOMIC ENERGY COMMISSION

Nuclear Science Abstracts

Vol. 4 No. 14
July 31, 1950

Technical Information Division, OSE, Oak Ridge, Tennessee

UNIVERSITY OF MICHIGAN LIBRARIES

NUCLEAR SCIENCE ABSTRACTS

Vol. 4 No. 14

Table of Contents for July 31, 1950

Category	Abstract	Page
DOCUMENTS REFERENCE LIST		iii
BIOLOGY AND MEDICINE		631
Radiation Effects	4128	
Radiation Hazards and Protection	4141	
Radiation Sickness	4151	
Radiography	4154	
Radiotherapy	4155	
Toxicology Studies	4185	
Tracer Applications	4191	
CHEMISTRY		645
Analytical Procedures	4225	
Crystallography and Crystal Structures	4228	
Deuterium and Deuterium Compounds	4233	
Fluorine and Fluorocarbons	4238	
Rare Earths and Rare Earth Compounds	4240	
Separation Procedures	4241	
Synthesis	4246	
Tracer Applications	4255	
Transuranic Elements and Compounds	4257	
Uranium and Uranium Compounds	4266	
ENGINEERING		654
Heat Transfer and Fluid Flow	4281	
Vacuum Systems	4283	
MINERALOGY, METALLURGY, AND CERAMICS		654
Ceramics and Refractories	4284	
Geology and Geophysics	4285	
Metals and Metallurgy	4287	
Minerals and Mineralogy	4297	
PHYSICS		656
Astrophysics	4303	
Cosmic Radiation and Mesons	4307	
Isotopes Separation	4318	
Instruments	4324	
Mass Spectrography	4326	
Mathematics	4329	
Measuring Instruments and Techniques	4332	
Meteorology	4350	
Neutrons	4351	
Nuclear Properties	4353	
Nuclear Reactors	4357	
Nuclear Transformation	4360	
Particle Accelerators	4374	
Radiation Absorption and Scattering	4376	
Radiation Effects	4382	
Radioactivity	4383	

TABLE OF CONTENTS FOR JULY 31, 1950

Category	Abstract	Page
PHYSICS		
Theoretical Physics	4391	
Tracer Applications	4401	
PATENTS		670
Biology	4406	
Chemistry	4407	
Engineering	4412	
Mineralogy, Metallurgy, and Ceramics	4415	
Physics	4416	
AUTHOR INDEX		A
SUBJECT INDEX		D
NUCLIDE INDEX		N
FOREIGN GEOGRAPHIC INDEX		P
PUBLISHED DOCUMENTS INDEX		P
LIST OF CONTENTS OF NNES PUBLICATIONS		R
NNES ANNOUNCEMENTS		S

ERRATA

The correct journal reference for NSA 4-2980, Vol. 4, No. 10, May 30, 1950, is Acta. Tuberc. Scand. Suppl.

The correct journal reference for NSA 4-3373, Vol. 4, No. 11, June 15, 1950, is Anesthesia & Analgesia.

Chemistry Library
QC
770
.U56
v.4
no.14

DOCUMENTS REFERENCE LIST

Vol. 4 No. 14

U. S. ATOMIC ENERGY COMMISSION DECLASSIFIED DOCUMENTS

Document	Title, Author	Abstract
AECD-2855	The Energy Loss of Particles Traversing a Slab of Finite Thickness. F. H. Murray.	4376
AECD-2856	Disintegration of He^3 by Fast Neutrons. J. H. Coon.	4360
AECD-2857	A Kinetic Study of Normal and Uranium Inhibited Hexose Metabolism in Yeast. L. Hurwitz.	4185

U. S. ATOMIC ENERGY COMMISSION UNCLASSIFIED DOCUMENTS

AECU-833	Micro Syntheses with Tracer Elements. XX. The Synthesis of Ethyl Di(4-Hydroxycoumarinyl) Acetate (Pelentan) Labeled with C^{14}. C. W. Bills, A. Murray, III, and A. R. Ronzio.	4246
AECU-834	Micro Syntheses with Tracer Elements. XIX. The Oxidation of C^{14} Formaldehyde to C^{14} Sodium Formate. A. Murray, III, and A. R. Ronzio.	4247
AECU-835	Micro Syntheses with Tracer Elements. XVII. The Synthesis of Oxalic and Glyoxylic Acids Labeled with C^{14}. C. W. Bills and A. R. Ronzio.	4248
AECU-836	The Removal of Plutonium from Laboratory Wastes. C. W. Christenson, M. B. Ettinger, G. G. Robeck, E. R. Hermann, K. C. Kohr, and J. F. Newell.	4257
AECU-837	Laboratory Studies on the Removal of Plutonium from Laundry Wastes. J. F. Newell, C. W. Christenson, J. D. Shaykin, H. L. Krieger, D. W. Moeller, and C. C. Ruchhoft.	4141
AERE-C/R-450	The Application of Turbulence Flow Theory to Transfer Processes in Tubes Containing Turbulence Promoters and Tubes. H. R. C. Pratt.	4281
BNL-51	Quarterly Progress Report, January 1 - March 31, 1950.	4302
COO-4	Determination of Activation Energies for Secondary Creep. Fifth Technical Report. T. H. Hazlett, E. R. Parker, and M. W. Nathans.	4287
COO-5	Change of State of Nickel During Secondary Creep at High Temperatures. Seventh Technical Report. K. B. Lloyd, T. H. Hazlett, and E. R. Parker.	4288
COO-10	Role of Sub-Structure Developed During Plastic Flow on the Mechanical Properties of Metals. Fourth Technical Report. E. R. Parker, T. H. Hazlett, and M. W. Nathans.	4289
COO-11	Some Considerations Concerning the Strain Hardened State of Metals. Sixth Technical Report. M. W. Nathans, E. R. Parker, and T. H. Hazlett.	4290
LA-1107	A Method for Monitoring X-rays Using Eastman Type K Film. E. Storm and E. Bemis.	4332

DOCUMENTS REFERENCE LIST

Document	Title, Author	Abstract
MLM-453	A Study of the Thermal Conductivity of Santocel. J. R. Parks.	4282
NEPA-1424	The Spectrochemical Analysis of Bismuth Matrices Employing the Porous Electrode Technique. J. C. Delaney and L. E. Owen.	4291
NYO-532	Progress Report for the Period July to December 1949. P. Fugassi and C. Markle.	4292
NYO-1508	Report on Studies of the Effect of X-ray Irradiation on Rabbits' Lens. L. von Sallmann.	4128
ORNL-556	A Thermistor Temperature Recorder for Meteorological Survey. C. A. Mossman, J. Lundholm, Jr., and P. E. Brown.	4350
ORNL-661	Anion Exchange Studies. I. Separation of Zirconium and Niobium in HCl-HF Mixtures. K. A. Kraus and G. E. Moore.	4241
ORNL-687	Changes in Cell and Plasma Volumes Produced by Total Body X-radiation. R. H. Storey, L. Wish, and J. Furth.	4129
ORNL-688	Studies on the Mechanism of the Oxygen Effect on the Radiosensitivity of Tradescantia Chromosomes. N. H. Giles, Jr., and H. P. Riley.	4130
ORNL-689	The Disappearance of Isotopically Labeled Gold Colloids from the Circulation of the Dog. C. W. Sheppard, P. F. Hahn, and G. Jordan.	4191
ORNL-695	Health Physics Division Quarterly Report for Period Ending April 15, 1950. K. Z. Morgan and F. Western.	4125
ORNL-696	Recent Developments in Yeast Genetics. Seymour Pomper.	4126
ORNL-706	Characteristics and Behavior of Bonded Wire Resistance Strain Gages in Thermal Coefficient of Expansion Measurements. Part I. SR-4 Paper Bonded A-7 and Bakelite Bonded AB-19 Gages. M. R. Goodman.	4324
UCLA-70	The Effect of Several New Antihistaminic Drugs upon the Mammalian Capillary Bed. T. J. Haley and M. R. Andem.	4127
UCLA-71	The Total Synthesis of Linoleic Acid. H. M. Walborsky, R. H. Davis, and D. R. Howton.	4249
UR-113	Pilot Experiments on Indications of Radiation Sickness and Comparison of Lethal Doses of X-rays for Rats and Dogs at Intensities of 160 r per Hour and When Delivered in 24 Hours. G. W. Casarett.	4151

BIOLOGY AND MEDICINE

4125 Health Physics Division Quarterly Progress Report for Period Ending April 15, 1950. K. Z. Morgan and F. Western. ORNL-695, May 26, 1950. 23p.

Activities of those groups primarily engaged in applied research or development are briefly reported. Instrument Development: fast neutron program, portable α survey meter, constant water monitoring, and β dosimeter. Waste Disposal Studies: water and liquid waste decontamination processes, survey studies of White Oak drainage system and Clinch River, instrumentation, and miscellaneous. Theoretical Physics: ionization and excitation losses of charged particles traversing matter, interpretation of cross section data, and fast neutron problem in tissue. Experimental Physics: radium analysis apparatus, stack gas dispersal studies, and instrumentation for aerial uranium prospecting. Special Problems: surface dose of uranium, backscattering of β particles with an extrapolation chamber, backscatter measured with β counter filled with argon and methane, absorption of β particles, and neutron monitoring. Urinalysis: analysis for radioactive strontium and method for removing impurities from lanthanum. Education and Training: AEC fellowship program.

4126 Recent Developments in Yeast Genetics. Seymour Pomper. ORNL-696, May 10, 1950. 25p.

This review paper is limited, in the main, to work that has been performed in the past decade. Among the topics discussed are the early genetic studies with Saccharomyces; mating types, crossing procedures, and sporulation; genetic markers (unique characteristics which can be demonstrated to be heritable); and biochemical mutants involving such agents as x-radiation and compounds such as potassium cyanide, lithium chloride, and camphor.

4127 The Effect of Several New Antihistaminic Drugs upon the Mammalian Capillary Bed. Thomas J. Haley and Margaret R. Andem. UCLA-70, May 15, 1950. 11p.

Using a method previously described (Haley and Harris, J. Pharmacol. Exptl. Therap. 95, 293(1949)), 15 new antihistaminic drugs have been evaluated for their ability to cause closure of the precapillary sphincters of the mammalian capillary bed. Anthallan, Chloro-Trimeton, 194-A, 194-C, and Antergan were the most potent local vasoconstrictors tested by this method. The vasoconstrictor effect produced by topical application of the antihistaminics to the capillary bed was produced at concentrations which were of the same order of magnitude as those obtained in animals or humans after oral or intravenous administration. All of the drugs caused closure of the precapillary sphincters, a decreased flow through the capillary bed and leukocyte sticking. The degree of activity was directly related to concentration. The relationship between vasoconstrictor activity and chemical structure is discussed. 21 references.

4128 Report on Studies of the Effect of X-ray Irradiation on the Rabbits' Lens. Ludwig von Sallmann. NYO-1508, Apr. 1, 1950. 4p.

This report contains preliminary results obtained in the following experimental approaches for the study of early effects of x-ray radiation on the rabbit lens: (1) In vivo observations with slit lamp and ophthalmoscope in regular intervals after irradiation in one dose of 2000 r or in divided doses. (2) Histological and cytochemical studies on irradiated and control eyes with special reference to changes in the content and polymerization of desoxyribonucleic acids in the epithelium cells. (3) Autoradiographic and analytic examinations on permeation and distribution of radioactive indicators in the lens at various time intervals after irradiation. (4) Examinations on the permeability of the blood aqueous barrier after radiation. (auth)

4129 Changes in Cell and Plasma Volumes Produced by Total Body X-radiation. R. H. Storey, L. Wish, and J. Furth. ORNL-687, May 16, 1950. 15p.

Following irradiation of rabbits by 1000 r of x-rays there was a large drop in erythrocyte volume as measured by P^{32}-tagged cells beginning with the 3rd day and reaching a depth at about the 17th day after irradiation, followed by a slow recovery. There was at first a slight concomitant plasma-volume drop followed by a rise on about the 10th day that elevated the lowered total volume but did not bring it up to normal in 23 days. Similar changes occurred in mice that were exposed to 575 r. 11 references. (auth)

4130 Studies on the Mechanism of the Oxygen Effect on the Radiosensitivity of Tradescantia Chromosomes. Norman H. Giles, Jr., and Herbert Parkes Riley. ORNL-688, May 24, 1950. 17p.

Previous experiments by the authors have demonstrated that the radiosensitivity of Tradescantia chromosomes, as measured by the occurrence of x-ray induced aberrations in microspores, is markedly influenced by the amount of oxygen present. Further experiments are reported here. Exposures of inflorescences to a single constant x-ray dose, but in atmospheres containing seven different percentages of oxygen, indicate that there is a rapid rise in aberration frequency between 2 and 21 per cent oxygen, with a gradual increase thereafter. Further studies are being made to clarify the effect of oxygen at levels between 0 and 2 per cent. Other experiments have been performed to determine whether the oxygen effect is exerted by way of the initial breakage mechanism or on the reunion process. These consisted of comparative exposures to a single dose of 300 r in one min of inflorescences in a vacuum or in oxygen with the addition or removal of oxygen either immediately after or during part of the irradiation period. The experiments show that the presence or absence of oxygen during the actual exposure to x-rays rather than during the postirradiation period is the important factor, thus demonstrating that the effect of oxygen in increasing the radiosensitivity of Tradescantia chromosomes results from an increased production of initial breaks rather than from an influence on the reunion of broken ends. (auth)

4131 Atomic Energy in the Service of Plant Ameliorating. R. De Vriese. Tuinbouw-Berichten 14, 28-29(1950) (in Dutch).

In commenting on the first results of experiments performed at the Argonne Laboratory on the irradiation of tulip bulbs with neutrons, the author points out that these experiments are a direct continuation of an investigation begun seven years ago in Amsterdam, Holland, by W. E. de Mol. In March 1943, 50 bulbs of a certain variety of gladiolus

were submitted for 1 to 4 hr to an irradiation with neutrons (150 g Ra-equivalent), followed by a treatment with x-rays; the plants, obtained during the following two years, produced a color mutation and showed a taller growth and a better bulb crop than the controls. In November 1943, 500 bulbs of three varieties of tulips were irradiated for 0.5 to 6.5 hr with neutrons (10 to 75 g Ra-equivalent); in 1944 the plants exhibited signs of suppressed development; in the 1946 growth one variety mutated into a large-flowered race, while another developed a color mutation; in 1948 the third variety also produced a color mutation; three new varieties of tulips were thus obtained, (called "Irene Joliot-Curie," "Rutherford," and "Chadwick"). In 1948 de Mol was permitted to pursue his work at Argonne. According to available information, the first-year tulip plants (1949) seem to have suffered from the previous (autumn 1948) 16-min long treatment of their bulbs with neutrons of one billion/cm^2 intensity; thus, the height of the plants was half the normal; the characteristics of the 1950 generation are not yet known. It should be remarked that all these results offer nothing substantially new: similar mutations are obtained by other physical means; it may perhaps be advanced that by using neutrons the mutation probabilities are augmented in a higher degree than by other agents.

4132 Capacitrons. H. E. Rasmussen. Konserves 8, 13-14(1950) (in Danish).

Capacitrons are an apparatus for the sterilizing of canned food products by the action of fast electrons. A short account is given of the recently completed experimental work in the United States, now permitting industrial applications.

4133 The Effect of Ionizing Radiations on the Broad Bean Root. VII. The Inhibition of Mitosis by Alpha Radiation. L. H. Gray and John Read. Brit. J. Radiology 23, 300-3(1950) May.

Broad bean roots were irradiated with α particles by immersion in radon solution; the dose was 12 to 237 energy units (1 energy unit = 1.1 roentgen equivalent physical = 93 ergs/g tissue) delivered over a period of 20 to 90 minutes. Tips were fixed 3 hr afterward and the number of cells seen in mitosis compared with control roots. When the logarithm of the percentage residual mitosis was plotted against the dose, the points defined a straight line. These results are compared with similar results obtained previously with neutron and γ rays. The ratio of the slopes of the neutron and α ray lines is the inverse of the ratio of the linear ion densities, suggestive of an effect brought about by a single recoil proton or an α particle. The relative efficiencies of γ rays, neutrons, and α rays in reducing the number of cells seen in mitosis in the bean root 3 hr after irradiation are 1:2.1:0.6, whereas the corresponding figures for the lethal effect are 1:9:9. (auth)

4134 The Influence of Adrenal Cortical Hormones on Sensitivity of Mice to Ionizing Radiation. J. B. Graham, R. M. Graham, and A. J. Graffeo. Endocrinology, 46, 434-40(1950) May.

More than 2000 adult Swiss mice including controls were given cortical extract (ACE), desoxycorticosterone (DCS) and 11-dehydrocorticosterone (HCS) at varying times before and after total body irradiation of 400 to 600 r. The procedure

BIOLOGY AND MEDICINE

is outlined, and the results are tabulated and discussed. The authors conclude that ACE given 10 days prior to irradiation increases the survival rate in both sexes, when given immediately before irradiation raises the mortality in females, and does not alter the survival rate under any other conditions tested; despite reasonable postulates that the adrenal cortex plays a significant role in the resistance to radiation, the authors did not find any evidence for the mediation of radioresistance by the adrenal cortical hormones used, and probably not by the cortex itself; they further conclude that the demonstrable effects of adrenal compounds on radioresistance are in the nature of a nonspecific stimulus since they may be duplicated by injection of other material such as foreign protein or estrogen.

4235 The Lethal Effect of Fast Electrons from a 6-Mev Betatron on Bacterium Coli Comm. C. Dieckmann, W. Dittrich, H. Reich, and G. Schubert. Naturwissenschaften 37, 140-1(1950) (Brief note, in German).

Lethal dosage curves were obtained for bacterium coli comm. irradiated with x-rays (180 kev, 6 ma, half value layer 0.27 mm Cu, 500 r/min), and with 3-Mev electrons. Total dosages ranged up to 4000 r. The rate of lethal injury increased for electrons as well as for x-rays exponentially with the dosage. It took 2300 r with electrons, but 3400 r with x-rays, to kill 50 per cent of the bacteria. Thus, electrons were 40 per cent more efficient than 180-kev x-rays. The authors interpret this as a saturation effect which corresponds to the predictions of target theory.

4136 On the Effect of Methylthiouracil and X-rays on the Thyroid Gland. C. Montag. Strahlentherapie 81, 1-38(1950)(in German).

An investigation of the effect of x-rays on the thyroid glands of rats was carried out with the use of methylthiouracil, a chemical substance which results in a pronounced histological change and makes it possible to influence the functioning of the thyroid gland in a measurable manner. Upon irradiation of the thyroid gland with approximately 1500 r, degenerative changes were found in the nervous terminal apparatus (preterminal plexus and nervous terminal reticulum) and in the nuclei of follicular cells. An effect on the protoplasm and the surface areas of the follicular cells is probable. The nuclear changes had previously been unobserved because they become apparent only during cell division. They are made visible by accelerating the mitosis by the administration of methylthiouracil.

4137 Roentgen Irradiation of Desoxyribosenucleic Acid. I. Mechanism of the Action of Irradiation in Aqueous Solution. G. Limperos and W. A. Mosher. Am. J. Roentgenol. Radium Therapy 63, 681-90(1950) May.

Desoxyribose nucleic acid (DNA) is water solution was irradiated with various doses of x-rays from a 120-kv source, at the rate of 1700 r/min; the DNA was placed in petri dishes (10 ml in each dish) and covered with a sheet of duralumin 0.001 in. thick before the irradiation. The DNA was found to be depolymerized in aqueous solution by the x-rays as well as by chemically generated free radicals; thiourea inhibited depolymerization by both means. These results were interpreted as evidence that the mech-

anism of action of x-rays on the DNA in water solution is indirect, mediated through the production of free radicals from the solvent; additional evidence of the indirect action was obtained by the inability of x-rays to depolymerize the DNA in a dry state, in ethylene glycol, or in frozen aqueous solution. The presence of NaCl and desoxyribosenuclease was found neither to inhibit nor increase the depolymerization. There was evidence of hydrogen bonding in the DNA. 20 references.

4138 Roentgen Irradiation of Desoxyribosenucleic Acid. II. Physicochemical Properties of Desoxyribosenucleic Acid from Irradiated Rats. G. Limperos and W. A. Mosher. Am. J. Roentgenol. Radium Therapy 63, 691-700(1950) May.

Male albino rats were irradiated from a 120 kv source in groups of 10 in a circular copper cage through a 0.75-mm Cu filter, with a total of 1000 to 2000 r, with or without prior injection with thiourea. The thymus glands were removed immediately or 24 hr later and extracted for DNA. The irradiation of the DNA in vivo produced two effects: (1) when the animals were sacrificed immediately after irradiation, the DNA extracted from the thymus was low in N (due to a splitting off of purine bases); (2) when the animals were sacrificed 24 hr after irradiation, the DNA was almost completely depolymerized. Thiourea injected before irradiation did not inhibit the splitting off of the purine bases from the DNA but did inhibit the depolymerization to some extent. Possible mechanisms for these reactions are suggested.

4139 The Role of the Spleen in Radiation Injury and Recovery. L. O. Jacobson, E. L. Simmons, E. K. Marks, M. J. Robson, W. F. Bethard, and E. O. Gaston. J. Lab. Clin. Med. 35, 746-770(1950) May. (See also NSA 3-207.)

In a study to compare the effect of 1025 r on the blood and blood-forming tissue of mice which had had lead protection of the surgically mobilized spleen during radiation with the effect of this dose on mice without lead protection, 165 female CF-1 mice aged 10 to 12 weeks were divided into four groups, including one control group of 40 animals and three other groups which were prepared by surgical mobilization of the spleen under nembutal anaesthesia. Two of the three groups received x-ray doses with irradiation delivered by a 250-kv machine through a 0.25-mm Cu filter, with a dose rate of 58.9 r/min at 55 cm; hematological, gross and microscopic tissue examinations, and determinations of body weight at various intervals were done. The data and results are extensively presented in graphs, tables, and plates; they are thoroughly discussed.

4140 Studies of Electrophoretic Serum Protein Patterns in Subjects Treated with Pituitary-Adrenal Cortical Hormones, Nitrogen Mustard, or X-radiation. Julian Frieden and Abraham White. Yale J. Biol. and Med. 22, 395-406(1950) May.

The serum protein patterns in dogs and in human subjects receiving adrenal cortical extract or ACTH, and in humans receiving x-ray therapy or nitrogen mustard therapy for carcinoma were investigated. The x-ray doses varied considerably. No significant alterations in the serum protein levels were seen in either man or in dogs following a single injection of ACTH or adrenal cortical extract. The x-ray irradiation of the patients with carcinomata produced no consistent changes in the serum protein levels; nitrogen mustard administration had no definite effect on the serum proteins either, despite a marked involution of the lymphoid tissue throughout the body.

4141 Laboratory Studies on the Removal of Plutonium From Laundry Wastes. John F. Newell, C. W. Christenson, J. D. Shaykin, H. L. Krieger, D. W. Moeller, and C. C. Ruchhoft. AECU-837, nd. 2p.

The document is in abstract from; it is reproduced below in its entirety.

Studies were made on the treatment of wastes from the laundry for contaminated clothing at Los Alamos. The wastes contained soap, synthetic detergents, citric acid, and lint. The five-day B.O.D.'s [biochemical oxygen demand] of the wastes varied from about 200 to 600 ppm. The alpha activity from plutonium was relatively low, averaging about 1500 cts/min/liter, but maxima of 20,000 cts/min/liter were observed. The objective in treatment was to reduce the plutonium activity in the discharged effluent to 70 cts/min/liter or less. A reduction in the B.O.D. was desirable but of secondary importance. Preliminary experiments indicated that either biological or chemical treatment could be used to remove the plutonium from the waste. Chemical treatment (carrier precipitation) might not be entirely successful because of coagulation difficulties caused by complexing agents. Because of excessive foaming, activated sludge treatment was not feasible on detergent wastes.

Single stage pilot trickling filter studies were initiated in the summer of 1949. A second stage filter was added later and the two-stage filter has been operated with recirculation ratios varying from 2/1 to as high as 30/1. Since the waste was deficient in biological nutrients, additions of ammonia and phosphate were made to the laundry waste prior to biological treatment.

Laboratory scale chemical coagulation experiments were made in parallel with the biological treatment. Alum would not always produce a floc. Ferric chloride generally did not produce a settleable floc at pH values less than 11.5. Generally, satisfactory plutonium removal was obtained by chemical precipitation with calcium chloride, lime, sodium hydroxide, activated silica, and ferric chloride added in sequence at pH values of 11.5 or higher.

The trickling filter was ineffective in B.O.D. or plutonium removal with recirculation ratios of 8/1 or less. With recirculation ratios of 15/1 and higher, analytical results indicated nitrification, 90% or more B.O.D. removal, and satisfactory plutonium removal. Optimum recirculation ratios, nitrogen and phosphorus requirements, and the disposal of sludge remain to be studied. The work indicates that the plutonium removal objective can be attained either chemically or biologically. Simplicity of operation and volume of sludge to be disposed of seem to favor biological treatment. (auth)

4142 Atomic Energy in Clinical Medicine. II. Protection Against Radiation. Ars Med. 5, 358-71(1950) May (in French).

This article reviews the inherent dangers in working at the various atomic energy installations in the United States

BIOLOGY AND MEDICINE

and the precautionary measures taken to protect the workers. Some of the topics discussed are monitoring of the atomsphere, waste disposal, personnel and area monitoring, and plutonium and beryllium poisoning.

4143 Damage to Ribs Exposed to X-rays in a Case of Mammary Epithelioma. V. Sváb. Časopis Lékařů Českých 88, 931-5(1949)(in Czech).

The author observed pathological changes in the ribs in eight patients irradiated for breast cancer; the changes were supposedly due to irradiation. He reports on five patients of his own and three patients irradiated in other institutes; in all cases tangential fields of deep x-rays were applied. The x-ray pictures of the damage to the ribs were the same in all cases: in the early stage the bony structure was interrupted in a limited part of the rib; in the later stage a sclerotic strip of bony tissue was formed at the border of the interrupted bone, 4 to 5 mm in extent. Healing took two to three years and even longer, and was accomplished only by central callus formation. These changes in the ribs were always found in the anterior axillary line or somewhat frontally; in this region the nutrition of the bone is poor, because it is the final area of blood supply of the posterior intercostal and the internal mammary arteries. In almost all patients there were cutaneous telangiectases; sclerosis of lung tissue was never found; there was no relation between the dose and the findings in the ribs. The author is of the opinion that the delayed healing and the absence of periosteal callus formation is the result of a temporary diminution of osteoblastic function of the rib tissue following irradiation.

4144 Facial Hemiatrophy, Sequel to the Treatment of an Extensive Nevus Flammeus (Port-Wine Mark) with X-rays and Radium. Tibor Benedek. Military Surgeon, 106, 466-9(1950) June.

A discussion is presented warning against the indiscriminate use of irradiation in the therapy of vascular tumors. One case is presented in detail where irradiation doses of 2000 r were applied without determination of the extent of previous radiotherapy, in a case where the tumor was definitely radioresistant, which resulted in atrophy, telangiectasia, hyperpigmentation, and potentially malignant ulceration in the irradiated area. The author advises no therapy for nevus flammeus especially irradiation, and the use of a cosmetic to cover the tumor.

4145 Lessons from Operation Crossroads. C. A. Erickson. Chicago Med. School Quart. 11, 91-5(1950) Apr.

A description is presented of the effects of the air and underwater explosions of the atomic bomb at Bikini. The tests showed the Navy, according to the author, that: ships at anchor and ships in tactical formation must be widely spaced; and design changes on ships should be effected to reduce damage above water, especially to the superstructure, and to provide greater protection to the personnel; the adequacy of theoretical safety measures was investigated. Under a separate heading the phenomena accompanying an atomic blast are described. Typical effects upon a city are outlined, including the zones of damage and the effects to personnel within the respective zones; blast, burn, and primary radiation effects are included, and the danger of radioactive cloud emission is also considered.

BIOLOGY AND MEDICINE

4146 Medical Aspects of the Effects of Atomic Explosion. J. N. B. Crawford. Can. Med. Assoc. J. 62, 529-34 (1950) June.

A general discussion is presented of effects of medical interest of an atomic bomb explosion, including general descriptive material on the blast itself, thermal and radiation injuries, clinical effects, the diagnosis of radiation injury, and the general treatment of casualties resulting from an atomic explosion.

4147 Public Health Aspects of Atomic Energy (Concluded). Roy J. Morton. Mississippi Doctor 28, 31-4(1950) June.

The problems of radioactive waste disposal with a minimum objective of insuring that the radioactive isotopes released into drainage systems, atmosphere, or soil must be incapable of sufficient concentration to be harmful to plant or animal life, are discussed, and some of the measures taken by the Atomic Energy Commission to insure this are presented. Air contamination measurements, dust filter systems, decontamination, and reclamation of some products and storage of decaying materials beyond a danger time are discussed. A short history of the waste disposal unit which was set up to evaluate hazards, to study the factors that influence the extent and significance of the hazards, and to aid in the development of effective and economical measures for prevention and control of hazards is given; the study program is described in more detail comprising three main branches: survey studies consisting of field sampling and evaluation; process studies consisting of laboratory and pilot plant studies on wastes; corollary studies consisting of the improvement of instrumentation and laboratory techniques as well as cooperating efforts with geological, meteorological, and ecological study programs.

4148 Radioactive Sewage. Discovery 11, 186-9(1950) June.

Nine photographs illustrating the disposal of waste water from the Harwell pile are shown.

4149 The Role of the Doctor in Atomic Defense. Shields Warren. Chicago Med. Soc. Bull. 52, 1051-3(1950) June 10.

The text of a speech presented before the Annual Clinical Conference of the Chicago Medical Society is given. It is a review of the general problems of a medical nature which will arise in the event of an atomic detonation in the air, on the ground, or under water. The need for all medical personnel to familiarize themselves with the events and emergency treatments, including rapid diagnosis, is emphasized.

4150 Shipping, Storage, and Handling of Cobalt-60. K. J. Parry. Atomics 1, 159-66, 177(1950) June.

In the Co^{60} program at Chalk River, a body of knowledge has been built up concerning the measurement of source strength, absorption of γ rays, shipping, storage and handling problems, and devices for handling very active sources. A summary of this information is given.

4151 Pilot Experiments on Indications of Radiation Sickness and Comparison of Lethal Doses of X-rays for Rats and Dogs at Intensities of 160 r per Hour and

BIOLOGY AND MEDICINE

When Delivered in 24 Hours. George W. Casarett. UR-113, Apr. 17, 1950. 88p.

Pilot experiments were carried out to investigate correlations among factors including radiation sickness and mortality, and dose and intensity of x-radiation (total-body-exposure). The source of radiation was a 1000-kv peak generator, equipped with a lead parabolic filter, and having a half value layer equivalent to 5.12 mm of lead. In a study of radiation sickness, single doses of 75, 150, 300, and 500 r were administered to groups of 12 rats each; and single doses of 40, 80, 120, and 200 r were administered to groups of 4 dogs each, at an approximate rate of 160 r/hr. Body weight determinations, food consumption measurement, and superficial physical examinations were made daily. There were no deaths among these animals. In rats, a dose of 500 r produced a transient radiation sickness of moderate degree, and a dose of 300 r produced a mild, transient radiation sickness. The effects of doses of 150 r and 75 r were slight and transient. In dogs, a dose of 200 r produced only a mild, very transient reduction in food consumption, and lower doses resulted in no significant change with regard to measurements made. In a comparison of lethal effects of x-rays, for rats and dogs, with intensities of 160 r/hr and when the dose was delivered in 24 hr, single doses of 600, 750, 900, and 1050 r were administered to groups of 20 rats each at a rate of about 160 r/hr, and single doses of 600, 750, 900, 1050, 1300, and 1500 r were administered to groups of 20 rats each at rates such that each dose was delivered in 24 hr. Single doses of 250, 310, 370, and 430 r were administered to groups of 6 dogs each at a rate of about 160 r/hr. Single doses of 300, 400, 500, 600, 750, and 1000 r were administered to groups of 6 dogs each at rates such that each dose was delivered in 24 hr. The data obtained, together with data from other sources, suggest that up to a certain point, decrease in intensity of single doses of x-radiation may result in decreased mortality to some extent. The data suggest, also, that a dose high enough to produce severe signs of radiation sickness will also have associated with it considerable mortality. Survival times, weights, clinical observations, and gross pathology observed at autopsy are described for these animals, as well as mortality. (auth)

4152 Application of the Sodium Salt of α-Oxybenzylphosphinic Acid in Long Irradiation with X-rays. K. Hohl. Praxis (Bern) 38, 568-9(1949)(in German).

Phoselit (Na salt of α-oxybenzylphosphinic acid) inhibited toxic side effects of x-ray irradiation; body weight restoration was especially accelerated by this drug. Phoselit increased glycogenesis acting as a H-donor in the oxidation-reduction process.

4153 Failure of Folic Acid to Influence Lethal Radiation Illness in Swine. Eugene P. Cronkite, John L. Tullis, Carl Tessmer, and F. W. Ullrich. Proc. Soc. Exptl. Biol. Med. 73, 496-7(1950) Mar.

Eight swine were exposed to 400 r total body radiation. Four were treated with intramuscular injections of 45 mg of folic acid per day. The clinical and hematological courses were observed and postmortem examinations were performed. No differences were observed in the responses of the treated and untreated swine. 11 references. (auth)

BIOLOGY AND MEDICINE

4154 A Radioautographic Method for Detailed Localization of Radioactive Isotopes in Tissues without Isotope Loss. Margaret W. Holt and Shields Warren. Proc. Soc. Exptl. Biol. Med. 73, 545-9(1950) Apr.

The radioautographic method described in this paper incorporates a number of desirable features. With this method, it is possible to prepare radioautographs from tissue that has been frozen and dehydrated in vacuum and mounted by procedures that avoid contact of the tissue with reagents that would extract the radioactive material. Sharp images are obtained; yet the method avoids possible difficulties due to direct chemical contact of the tissue with the photographic emulsion. There are no difficulties in staining and developing, since the two slides are handled separately. Since the two images are on separate slides, the photographic image formed does not obscure structural details of the tissue section or vice versa; comparisons are always made on the same tissue section that was used in making the photographic exposure. It is possible to match localizations accurately on the two slides.

4155 Advances in Radiotherapy. T. A. Watson. Can. Med. Assoc. J. 62, 540-4(1950) June.

A general informative discussion including a brief history of radiotherapy of all types is presented, with special consideration of evaluation of types for maximum effect with minimum danger to the patient and attendant. Consideration is also given to radioisotopes of phosphorus, iodine, and cobalt and their applications, and special devices for producing higher voltage x-rays such as the cyclotron and the betatron. The author concludes that in the new field of radiotherapy the physicist must play the important role in advancing new techniques for use in medicine.

4156 Curietherapy for Cancer of the Uterus at the Radium Institute of Our Lady of Mercy Hospital. José Manuel Suárez Fernández. Rev. med. Cubana 60, 107-19(1949) Feb.

The results of the treatment of a number of cases of cancer of the uterus at the Radium Institute of Our Lady of Mercy Hospital with curietherapy are presented. Radium applicators delivered a total dose of 5000 to 6000 mg-hr in fractional doses of 48 hr to the uterine cavity and fundus. The five-year absolute cure rate in 542 cases was 13.1%. The author concludes that the statistics presented compare favorably with those obtained with this method in other countries.

4157 Dosimetry in Plesioroentgenotherapy. Arturo Gilardoni. Radioterapia, radiobiologia e fisica medica 2: 269-72(1949)(in Italian).

A study was made of the role played in plesioroentgenotherapy by the characteristic secondary radiations that are emitted by the tube and the metal localizers. The inconveniences are enumerated that these secondary radiations may cause both in therapy and in dosimetry. Practical rules are suggested for their elimination, together with several hints concerning dosimetric determinations in plesioroentgenotherapy using tubes of the normal type. (auth)

4158 The Effect of X-ray Therapy on Bitemporal Hemianopsia Caused by Pituitary Tumor. Karl Overhof

and Theodor Siekmann. Strahlentherapie 81, 39-62 (1950)(in German).

In this review the authors evaluate 100 cases of visual disturbances caused by pituitary tumors. It was found that in 79 per cent of the cases essential improvement was brought about and that blindness was removed in 9 cases out of 17. The effect of x-ray therapy is stated to be most favorable for the treatment of acromegaly, Froehlich's disease, and of those tumors which involve only visual disturbances but no endocrine symptoms, i.e., tumors which pathologically and anatomically are essentially adenomas.

4159 End Results and Treatment of Cancer of the Tongue. B. W. Windeyer. Am. J. Roentgenol. Radium Therapy 63, 719-26(1950) May.

The results of the treatment of 243 patients with cancer of the tongue are presented. Ten primary lesions of cancer in the anterior two-thirds of the tongue were usually treated by the implantation of radium or radon needles; primary lesions of the posterior third were treated mainly by teleradium alone; glandular metastases were treated by block dissection, and, in cases of fixed, inoperable glands, by teleradium. The teleradium method consisted of delivering 6000 to 7000 r over a period of 30 to 40 days with a 4-g applicator having a filtration of 1.8 mm Pt, at a radium skin distance of 8.4 cm and a dosage rate of 427 r/hr. The total dosage in radium needle therapy was usually 6000 to 9000 r_γ delivered over a period of 6 to 8 days. The ten-year end results were 13.1% cured and the five-year end results were 21.3% cured for all cases.

4160 End Results of Radiotherapy of Cancer of the Tongue. Juliette Baud. Am. J. Roentgenol. Radium Therapy 63, 701-11(1950) May.

The results of the radiotherapeutic treatment of 1055 patients with epithelioma of the tongue at the Curie Foundation in Paris from 1919 to 1945 are presented. The therapy was mainly carried out with the application of radium needles in and around the tumor; the total doses delivered were 1330 to 1596 mg-hr for the stage 4 cases. The results obtained have been best in the group where the tumor arose either on the dorsum or lateral borders of the tongue, and less satisfactory where lesions occurred on the tip, infralingual region, and the base of the tongue. External irradiation by radium molds, telecurietherapy and roentgen therapy added to radium puncture have not appreciably improved the results. Block dissection of the neck, performed routinely since 1936 for lesions on the movable part of the tongue, was done in 362 cases and a number of them with metastatic lymph nodes were thus cured.

4161 End Results of Treatment of Cancer of the Tongue. Elis Berven. Am. J. Roentgenol. Radium Therapy 63, 712-15(1950) May.

The results of the treatment of a large number of patients with cancer of the tongue by the teleradium method are presented. The teleradium treatment was delivered through five or more portals (two portals on the primary tumor, one portal on the upper cervical group of lymph nodes, one on the submaxillary triangle, and one on the nodes in the supraclavicular region) for a total dose of 4000 to 5000 r_γ/field. Daily doses of 1000 r_γ were given, at the rate of 9 to 11 r_γ/min. Radical block dissection of the cervical lymph nodes

was performed in cases where metastases were present and electrocoagulation was applied to the primary tumor. From 1921 to 1930 the absolute five-year cure rate was 15.2%, while for the period 1931 to 1942 the absolute cure rate was 24.8%. The author concludes the method described seems to be a fairly good cure for primary tumor of the tongue.

4162 First Therapeutic Results Obtained with the Aid of Artificial Radioactivity. J. H. Muller. Schweiz. med. Wochschr. 80, 437-8(1950) Apr. (in French).

A general discussion is presented of the type of data obtained by the use of radioisotopes in three basic research branches: the localization of metabolic pathways; the localization of the isotope in studies of the chemical states of molecules; and, the localization of artificial radioactivity in radioactive application therapy. The first branch is typified by the use of P^{32} in the treatment of chronic lymphatic leukemia and polycythemia vera, the use of Zn^{65} intravenously in large doses for mammary cancers, and the use of I^{131} for thyroid conditions; Zn^{65} and colloidal preparations of Au^{198} have been used in the second branch; an example of research in the third classification is the use of liquid suspensions of Co^{60} for cancers of the uterus and rectosigmoid.

4163 Hypothyroidism Produced by Radioactive Iodine (I^{131}) in the Treatment of Euthyroid Patients with Angina Pectoris and Congestive Heart Failure. Early Results in Various Types of Cariovascular Diseases and Associated Pathologic States. Herrman L. Blumgart, A. Stone Freedberg, and Geroge S. Kurland. Circulation 1, 1105-41(1950) May.

Hypothyroidism, induced by I^{131} to lessen the work of the heart, is proposed as a means of treating certain patients with angina pectoris and congestive failure who are refractory to the standard medical measures; 18 such patients have been treated receiving a total of 25.5 to 150 mc; the average dose was 54 mc. The period of follow-up averages 13 months. Eight of the 13 patients with angina pectoris and 3 of 5 patients with congestive failure showed worth-while improvement; in 6 of the 18 patients, the improvement was striking. Tentative criteria for the selection of patients, their pre- and post-treatment management, and detailed descriptions of the results are presented. 75 references. (auth)

4164 Isotopes for Medicine. W. Schweisheimer. Trained Nurse Hosp. Rev. 123, 172-3, 178(1949) Oct.

A discussion is presented of the use of isotopes in cancer studies, basic cellular metabolism, and therapy. The author lists the isotopes which are available and which are being used including some indication of their uses; also mentioned is the need for training programs for personnel using radioactive material, and some hazards, such as radiation injury and accidents, which may occur in the use of radioactive isotopes, x-ray machines, and cyclotrons.

4165 Low Dosage Pituitary-Ovarian Irradiation in Secondary Amenorrhea and Associated Sterility. Charles J. Collins. Southern Med. J. 43, 527-31 (1950) June.

Replies were received by the author from 410 gynecologists to a questionnaire asking for their opinion and experience with low dosage radiation to the pituitary or ovaries

in the treatment of secondary amenorrhea. The author's study of his records of 70 patients treated for functional menstrual irregularities showed improvement or success in 85% and failure in the other 15% with 37 pregnancies resulting among the 61 which were regarded as eligible for pregnancy. The x-irradiation was delivered by a 140-kv machine filtered by 0.25 mm Cu and 1 mm Al at a distance of 50 cm in doses of 72 r to the anterior pelvis giving an approximate ovary dose of 35 r for a series of three doses at one week intervals, and 36 r to each lateral pituitary region; the total air dose administered to the pelvis was 216 r giving 105 r to the ovaries for a patient measuring 20 cm in thickness, and the total dose to each lateral pituitary region was 108 r with a depth dose of both pituitary ports of 90 r (all measurements in air). Supplementary therapy, dangers, and possible harmful effects are discussed.

4166 Making the Radiation Beam from an X-ray Depth Therapy Apparatus Similar to That of a Short-Distance Irradiation Tube. Paul Ott. Strahlentherapie 81, 123-8(1950)(in German).

The biological effect of x-rays or radiation from radium is independent of the wave length. Thus, for therapeutic purposes, two radiation beams can be considered equivalent, if the geometric conditions are the same and the dosages in homologous parts of the beam are identical. The author shows here how apparatus for x-ray depth therapy (180 kev, 0.75 mm Cu filtration) can be adapted to use for short distance irradiation by changes in voltage and filtration.

4167 Modern Methods of Treatment for Malignant Tumours of the Eye. C. E. Davies. Can. Med. Assoc. J. 62, 568-71(1950) June.

A discussion is presented of diagnosis and treatment of malignant tumors of the eye including melanomata of the iris, melanomata of the choroid, malignant melanomata of the bulbar conjunctiva, and retinoblastomata. Seven cases are given in detail; the author recommends pre-operative and post-operative radiation of the tumor by means of a radium bomb giving a dose of 500 mg-hr in a child to 1000 mg-hr in the case of an adult, especially in cases where the glass eye is extruded or threatens to be extruded. Mention is made of combining the radium therapy with deep x-irradiation or the possible use of radon seeds in place of radium bombs when the technique and dosages of radon emanation become established.

4168 Note on the Radiotherapy of Certain Types of Dermatosis. Franco Fugazzola. Radioterapia, radiobiologia e fisica medica 2: 273-80(1949)(in Italian).

A short report is given on the application of roentgenotherapy in several cases of acute, subacute, and chronic dermatosis, by using the technique of small doses (15 to 50 r), weak filtrations (1 Al), and tensions of 80 to 120 kv, depending on the condition of the skin (whether almost normal or presenting various degrees of infiltration or keratosis). The results were favorable in a considerable proportion of cases. The probable mechanism of the radiological action in the cases examined is discussed. (auth)

4169 The Present Status of the Medical Treatment of Hyperthyroidism. D. M. Baltzan. Can. Med. Assoc. J. 62, 439-43(1950) May.

A discussion is presented of therapeutic grading, therapeutic rationale, subacute states, and acute thyrotoxicosis including consideration of preoperative medications, propylthiouracil therapy, and the use of radioactive iodine in patients who are sensitive to ordinary iodine or propylthiouracil and who are poor operative risks.

4170 Radioactive Iodine in the Diagnosis of Thyroid Disease. Bengt Skanse. Acta Med. Scand. 136, Suppl. 235, 186p. (1949).

The iodine-tolerance (I^{131}) test measures the capacity of the thyroid gland for taking up I. In totally thyroidectomized animals practically all I^{131} is excreted. The standard test is made with a mixture of 100 γ I and 100 μc I^{131} given orally. The amount excreted in 2 to 24 hr periods is measured. The percentage of I^{131} excreted is practically the same from a 100 to a 14,000 μc dose. The method for determining I^{131} in urine is described. In normal subjects 65.9 ± 0.7% I^{131} is excreted (44.0 to 87.8). In thyrotoxicosis 98% of the patients show a total excretion that is abnormally low in I^{131}. In euthyroid patients, with various thyroid diseases, the excretion is never less than normal. Myxedema patients show a total excretion that is normal or increased but is invariably delayed. Administration of dry thyroid, antithyroid drugs, or iodides increases the excretion of I^{131}. Kidney disease tends to lower the excretion. Excessive ingestion of thyroid hormone can be clearly differentiated from thyrotoxicosis since all I^{131} is excreted in the urine. The test is far superior to the determination of the basal metabolic rate in the diagnosis of thyrotoxicosis.

4171 Radioisotopes — General Considerations: Newer Applications of Radiant Energy in Cancer Research and Therapy. Murray M. Copeland. Am. J. Med. Technol. 16, 144-51(1950) May.

A general discussion is presented of the use of radioisotopes in medicine in two categories: (1) as tags which are extremely specific and which may be identified in minute quantities; (2) as radiation emitters especially for highly specific tissue as seen in some cases of neoplasmic disease. The first type is exemplified by the use of I^{131} in studying thyroid conditions, P^{32} in studying breast cancers and gastric secretions, and Fe^{55} and Fe^{59} in studying iron metabolism in normal and pathological states such as anemias. The second type of investigation is exemplified by the use of I^{131} for thyroid disease, P^{32} for polycythemia vera and leukemic states, Mn^{52} in cases of lymphoid leukemia and lymphosarcoma, Au^{198} used similarly to Mn^{52}, Na^{24} in various neoplastic disorders especially chronic cases, Sr^{89} for osteogenic sarcoma, Ca^{45} for a variety of diseases, and Ga^{72} for osteogenic lesions. The author concludes that many of these isotopes and their uses are experimental and that the utilization of radioisotopes as a tool to replace radium and x-ray therapy is not indicated at the present time.

4172 Radiotherapy of Xeroderma Pigmentosum. G. Arrivabene and G. Ghirelli. Radioterapia, radiobiologia e fisica medica 2, 294-305(1949)(in Italian).

Various radiotherapeutical techniques were used in six cases of xeroderma pigmentosum: in one case diathermobistoury and radium were applied; in another, radium treatment was followed by plesioroentgenotherapy; while in four cases the last named technique alone was used. In the radium

treatment 3 to 8 sources were applied, each containing 2 or 5 mg RaE, filtered through 2-mm Pt equivalent, focal distance 2 to 3 cm. The plesioroentgenotherapy consisted of daily treatments of the lesions with 500 to 1000 r, the total doses being 5000 to 13,000 r, focal distance 1.5 or 3 cm. It was concluded that plesioroentgenotherapy should be considered as the most appropriate method, if applied early enough.

4173 Roentgen Therapy of Bursitis of the Shoulder. David Robinson. J. Med. Assoc. Georgia 39, 205-9 (1950) May.

After a brief review of the literature, including diagnosis, etiology, and the various types of therapy in use at the present, data is presented from 61 cases treated with x-ray resulting in a satisfactory response in 51 cases. X-irradiation was delivered by a 200-kv machine, filtered by 0.5 mm Cu and 1 mm Al filters, at a focal distance of 50 cm, giving an average dose of 100 to 150 r (in air) per treatment, for a series of 3 to 6 treatments, with the interval between doses varying from 2 to 5 days.

4174 Roentgen Therapy in Neuroblastoma. A Review of Seventy-Three Cases. Martin H. Wittenborg. Radiology 54, 679-88(1950) May.

A complete discussion is presented of 73 selected cases of neuroblastoma in children between the ages of birth and 16 yr who received roentgen therapy as a part of the course of the treatment. Roentgen irradiation was delivered by a 160 to 200-kv machine, with 0.25 to 0.5 mm Cu and 1 mm Al filters, at a focal distance of 50 to 100 cm giving doses of 312 to 1400 r (in air); the course of therapy and dosage timing was dependent on the individual case and the techniques in use at the time; graphs and diagrams are given and discussed to show the type of therapy used and its rationale in smaller groupings of patients divided by site and extent of involvement and age. A cure rate of 30% was found, some of whom have been followed 12 to 16 years since the diagnosis; the complications of irradiation therapy in children are discussed and the author concludes that the limiting dosage factor is the volume of hematopoietic tissue exposed to the irradiation, and not the skin area exposed. In this series a single fatality due to x-ray therapy was observed.

4175 Short-Distance X-ray Therapy of Skin Tumors, Methods and Results. H. Stech. Strahlentherapie 81, 73-80(1950)(in German).

The author reviews 551 cases of skin tumors, both malignant and benign, which were treated under his direction by means of short-distance x-ray therapy within 8 yr. It was found that in ⅔ of the cases the symptoms were removed for from 2 to 5 yr, while in ⅓ permanent successes (6 to 8 yr) were achieved. According to the author's experience, repeated daily irradiation with 300 to 600 r is preferable to one intensive irradiation. The total dosages used ranged from 8000 r to 12,000 r.

4176 The Technique and Results of Treatment of Cancer of the Tongue with a 10-Gram Radium Beam Unit. Constance A. P. Wood. Am. J. Roentgenol. Radium Therapy 63, 727-38(1950) May.

The technique and the applications of the 10-g radium beam unit employed at the Radiotherapeutic Research Unit of the Medical Research Council, Hammersmith Hospital, London, England, are described. The therapeutic procedure aimed at delivering 6000 r to the primary tumor and glands over a period of 42 days, at the rate of about 1000 r/week, with 1 to 2 doses daily. The five-year survical rate on 182 patients was 26%.

4177 The Treatment of Cancer of the Cervix at the Norwegian Radium Hospital. E. Schjøtt-Rivers. Nord. Med. 42, 1642(1949).

From 1932 to 1941, 1035 of 1090 patients were submitted to radiological treatment while the remaining 3.2% were not treated at all. After five years 35.8% (40.7% of the treated cases) were cured and had no recurrence, distributed as follows (the number of treated cases is given in parentheses): stage I 61.8% (275), stage II 48.3% (298), stage III 27.6% (399), stage IV 6.6% (83). Up to and including the first half of 1945 the treatment of 88 cases was supplemented by prophylactic hysterectomy, as a rule six weeks after completion of the radiological treatment. The results of this treatment are accounted for as follows: 1 postoperative death, 24 deaths, 5 deaths from intercurrent diseases, 2 alive with recurrences, 70.5% of those operated upon (stages I and II) alive without recurrence (the period of observation, however, does not yet amount to five years for all cases). Operation revealed that the classification on the basis of the clinical examination alone had been too favorable in almost 10% of the cases.

4178 Treatment of Cancer of the Tongue. Stanford Cade. Am. J. Roentgenol. Radium Therapy 63, 716-18(1950) May.

This report is based on a study of 365 cases of cancer of the tongue, covering a period of 25 yr up to 1945. Radium was the treatment of choice; in about 7% of the cases surgical excision was indicated. For lesions of the anterior part of the tongue, insertion of radium needles was performed; in lesions of the vallecula, epiglottis, glossopalatine folds, or in the posterolateral group spreading to the alveolar mucosa or palate, teleradium was used. The total dose delivered was 6000 to 9000 r_γ in 168 hr, at the rate of 30 to 75 r_γ/hr. The 5 to 15-yr survival percentage was 27% of all the cases.

4179 The Use of Beta Irradiation in Ophthalmology. Frederick W. Stocker and Samuel D. McPherson, Jr. North Carolina Med. J. 11, 65-7(1950) Feb.

A radium applicator devised by Iliff is described here and the results obtained by its use in the treatment of eye conditions are presented. The applicator is rectangular (6 × 12 × 6 mm) and contains 50 μg of radium salt; the sides and back are constructed of silver and are, respectively, 1 and 3 mm in thickness. The front or treatment surface is covered with a 0.1-mm layer of monel metal; a handle 28 cm in length is screwed into the back of the plaque. A total of 25 eyes have been treated with this applicator emitting β irradiation; vernal conjunctivitis, inflamed or recurrent pterygia, pseudoterygia, corneal vascularization, and papilloma cases were given irradiation for 10 to 70 min per unit area. The results were uniformly successful except in one case of sclerosing keratitis.

4180 The Use of Radioactive Iodine in Hyperthyroidism. A Report of Three Cases Unsuccessfully Treated.

Arnold S. Jackson. J. Intern. Coll. Surgeons 13, 583-91(1950) May.

The case histories of three patients with exophthalmic goiter unsuccessfully treated with radioactive iodine and who required operation are reported; treatment had been given to one patient four times over a period of nine months and to two patients twice in six months. The question may arise whether further treatment might not have arrested the disease. All patients were becoming progressively worse with radioiodine therapy; all were in a marked stage of hyperthyroidism with an average weight loss of 25 pounds (11.3 kg), with an average basal metabolic rate of plus 60% and with progressive exophthalmos. Radioactive iodine has no place in the treatment of adenoma with hyperthyroidism, since only surgical measures will remove the tumor. Propylthiouracil will prepare patients with severe adenoma with hyperthyroidism for operation, as will Lugol's solution in cases of exophthalmic goiter. Both hyperthyroid states may be reduced to a safe state for thyroidectomy.

4181 The Use of Radioactive Iodine in the Diagnosis of Hyper- and Hypo-Thyroidism. W. F. Perry and J. P. Gemmell. Can. Med. Assoc. J. 62, 484-9 (1950) May.

In order to assess the relative reliability of radioiodine determinations in the study of plasma protein bound iodine for the diagnosis of thyroid disorders and to determine which of the radioactive methods used is best suited for clinical use, 35 patients with thyroid diagnoses of euthyroid, hypothyroid, and hyperthyroid received about 100 mc, in most cases, of radioactive iodine in water. The protein-bound plasma iodine was estimated by the Perry Cosgrove method in plasma taken at 24, 48, and 72 hr after administration; the radioactivity of the urine was also determined at these intervals; the results are tabulated, histographed, and discussed. The authors conclude that the methods which combine the greatest differentiation with the greatest simplicity were determination of 24 hr thyroid uptake of radioactive iodine and the estimation of the amount of the isotopes excreted in the urine in the period between 15 and 24 hr after administration; they conclude further that the concentration of radioactive protein bound plasma iodine was found to be greater in hyperthyroid subjects at all times examined, but in hypothyroidism the concentrations are comparable to the euthyroid subjects.

4182 Use of Radioisotopes in Medical Practice. R. R. Newell. Radiology 54, 752-4(1950) May (Editorial).

The uses of radioisotopes in therapy and clinical diagnosis are discussed and qualitatively weighed against the use of radium and x-ray radiation for various conditions. I^{131} for measuring thyroid function and P^{32} for chronic leukemia and polycythemia vera are mentioned as two examples of their use in cases which may not be placed in the hands of radiologists and clinics which are completely staffed and equipped to deal with all types of research including the special techniques needed for extensive radioisotope work.

4183 Use of Radon Ointment in the Treatment of Post-Irradiation Ulcers. Paul E. Repass. Rocky M. Med. J. 47, 432-4(1950) June.

The results of the treatment of eight cases of post-irradiation ulcers with radon ointment are presented. In two of the cases the ulcer healed, while in four of the cases some reduction in size was noted but recurrence of the epithelioma in the ulcer margin or nearby skin necessitated further x-ray treatment; in two cases the ulcers improved under the treatment but skin grafting was considered advisable because of the presence of extensive, thick scar tissue. On the basis of the results obtained radon ointment application is considered a valuable method of treatment of late radio-necrosis, but cases failing to respond should have, the author states, a biopsy for possible recurrence or persistence of carcinoma.

BIOLOGY AND MEDICINE

4184 X-ray Treatment of Plastic Indurations of the Penis. Ottavio Businco. Radioterapia, radiobiologia e fisica medica 2, 308-14(1949)(in Italian).

X-ray treatment was used in five cases of plastic induration of the penis, with 200 r doses (180 kv, 0.5 Zn + 2 Al, 2 ma) applied each on a dorsal, a ventral, and two lateral fields. The patients were subjected to 2 to 5 treatment periods. Clinical cure and reduction of fibrotic processes were observed in three cases, while no improvement was obtained in the two remaining cases. The history of the three former cases mentioned a past gonorrhea. In the author's interpretation, the treatment gives satisfactory results in processes that can be traced to an inflammatory cause, while it is of no avail in cases of a constitutional fibrotic diathesis. This opinion is corroborated by the fact that the doses employed here are well within the limits observed in the radiotherapy of inflammatory processes. (auth)

4185 A Kinetic Study of Normal and Uranium Inhibited Hexose Metabolism in Yeast. Leon Hurwitz. AECD-2857, May 3, 1950, Decl. June 15, 1950. 108p.

The industrial use of uranium in recent times has led to several toxicological problems. One of the most important of these is the deleterious effect of uranium on normal renal function. In order to gain some understanding of its poisonous action in the kidney, several investigators have found it valuable to determine the effect of uranium on cellular metabolism. Yeast cells being much easier to work with than kidney cells, they have been considered preferable for these studies.

Kinetically, glucose appears to form a loose complex with the active cell groups involved in aerobic and anaerobic metabolism, leaving the glucose mostly in the free state. The K_s (dissociation constant) for aerobic metabolism is 3.6×10^{-3} and for anaerobic metabolism 4.4×10^{-3}. Fructose was also found to form a loose complex with the active cell groups under anaerobic conditions. Its K_s is 1.9×10^{-2}. The maximum velocities of anaerobic glucose and fructose metabolism are equal. The value is approximately 28 μl CO_2 per milligram yeast per hour at 25°C and pH 3.5. This may indicate that a single enzyme system or that equal concentrations of two different enzymes dominate the rate-limiting step in the metabolic scheme. The rate-limiting step in the aerobic metabolism of glucose is slower than in the anaerobic metabolism of glucose. Its velocity is 13.30 μl per milligram yeast per hour at 25°C and pH 3.5. It has been shown that the anaerobic production of CO_2 by yeast is proportional to the anaerobic utilization of glucose. Evidence was presented to show that the rate-limiting process on the yeast cell surface is an enzymatic reaction thus lending support to the theory of active transfer of material across the cell membrane. Anaerobically, there exists for the most part a noncompeti-

tive inhibition of glucose metabolism by uranium. However, some degree of competition can be found in both aerobic and anaerobic glucose metabolism. In the fermentation of fructose, competition is apparently due to a uranium-substrate combination. The temperature characteristics of aerobic glucose metabolism is about 12,700 cal/mole between 18°C and 30°C and 20,850 cal/mole between 18°C and 10°C. When uranium is added the temperature characteristic becomes 23,400 cal/mole throughout the whole temperature range measured with no break at 18°C. In the anaerobic metabolism of both glucose and fructose, the temperature characteristics are about the same. They increase as temperature decreases whether uranium is present or not. In the control data, average (μ) values are about 21,800 cal/mole between 20 and 25°C, and 10,700 cal/mole between 25 and 30°C. In the presence of uranium, the anaerobic metabolism of fructose and glucose has an average temperature characteristic of 17,000 cal/mole between 20 and 25°C and 23,000 cal/mole between 25 and 30°C. The increase in aerobic (μ) values when uranium is added amounts in effect to a reversal of inhibition as the temperature is raised between 18 and 30°C. This also holds true for anaerobic glucose and fructose metabolism between 25 and 30°C. Uranium forms a complex in a 1/1 ratio with active groups in the anaerobic glycolytic system. The initial steps in the respiration and fermentation of glucose are accomplished by different systems, each possessing widely different characteristics. It has been postulated that either the aerobic, anaerobic, or both systems associated with glucose metabolism may be the composite of a number of dissimilar processes. 33 references.

4186 Beryllium Granulomatosis. John Gerrie, Fred Kennedy, and S. L. Richardson. Can. Med. Assoc. J. 62, 544-7(1950) June.

A discussion is presented of the dangers of beryllium poisoning and its effects, including a case history of skin granuloma resulting from beryllium contact. The author concludes that the only method of avoiding this hazard is the withdrawal of beryllium from industry.

4187 Beryllosis. Franz Borbély. Schweiz. med. Wochschr. 80, 323-6(1950) Apr. 1 (in German).

This is a general review of the subject of beryllium poisoning, especially as it occurs in industrial work involving beryllium. After a historical introduction, the clinical symptoms of beryllosis are described and the case material consisting of several hundred cases observed in Germany, the United States, and Russia is summarized. Over 40 literature references.

4188 Biological Studies with Polonium, Radium, and Plutonium. Robert M. Fink. New York, McGraw-Hill, 1950. 411p. NNES Div. VI, Vol. 3.

The general problem undertaken is a comparison of the biological effects of the three α particle emitters, polonium, plutonium, and radium. Part I deals with the distribution and excretion of polonium, Part II discusses the distribution and excretion of radium, and Part III deals with the comparative toxicities of polonium, plutonium, and radium. The book includes a critical survey of available literature concerning these elements. It also describes carefully controlled rat experiments designed to determine accurately the relative

toxicity of single injections of radium, polonium, and plutonium over a very wide range of doses, and discusses further the probable correlations between the toxicity results and retention and distribution data. The correlation between the individual papers in the volume and the respective U. S. Atomic Energy Commission declassified or unclassified documents is found in the Published Documents Index of this issue.

4189 The Effect of Different Dose Levels of Zirconium on the Excretion and Distribution of Plutonium and Yttrium. Jack Schubert and Marcia R. White. J. Biol. Chem. 184, 191-6(1950) May.

Early administration of zirconium citrate to rats previously injected with tracer levels of plutonium, Pu^{239}, and yttrium, Y^{91}, results in a marked increase in the urinary excretion and a considerable decrease in the bone content of the injected radioelements. Relatively large amounts of zirconium, about 200 mg/k, were used in these experiments. In order to clarify the mechanisms involved, graded dose levels ranging from 12.3 to 1336 mg/k as Zr have been given. (auth)

4190 Studies of the Toxic Action of Gallium. H. C. Dudley, Katherine E. Henry, and B. F. Lindsley. J. Pharmacol. Expti. Therap. 98, 409-17(1950) Apr.

In order that radiogallium studies may be properly evaluated, work on the toxicity of gallium, including the effects of injected gallium lactate on larger animals, the toxic action of gallium citrate on many different species of animals, and the changes in blood and urine of rabbits receiving toxic doses of gallium citrate was instituted. The experiments are briefly described and some of the results are tabulated; the authors conclude that: gallium lactate is much more toxic on a mg/kg basis for larger animals than for smaller ones; gallium citrate is more suitable as a means of administering soluble gallium to experimental animals than gallium lactate; gallium citrate is not absorbed by the gastrointestinal tract and produced no significant effect when fed to rats for 13 weeks; the toxicity in terms of LD_{50} in ten days of gallium citrate, expressed in mg/kg body weight, was found to be 600 for mice, 220 to 240 for small rats (50 to 100 g), 100 for larger rats (200 to 300 g), 45 for 2.0 to 2.5 kg rabbits, and 10 to 15 for goats and dogs; blood and urine analyses showed that toxic doses of gallium citrate in the rabbit induced marked kidney changes followed by albuminuria and glycosuria, an increase in blood urea nitrogen and nonprotein nitrogen, and an uncompensated acidosis with significant changes in the serum sodium and potassium levels.

4191 The Disappearance of Isotopically Labeled Gold Colloids from the Circulation of the Dog. C. W. Sheppard, P. F. Hahn, and Gilbert Jordan. ORNL-689, May 22, 1950. 25p.

Immediately following injection of radioactively tagged colloidal gold particles in the dog the circulatory level drops exponentially with time, the half-value time being about 1.5 min. A very low residual level is reached in about 10 to 20 min showing occasional fluctuations. A high concentration of activity is then found in the buffy coat fraction, and if blood is withdrawn and transfused into a second

animal the initial rapid rate of decline is not observed. The possibility is explored that the rate of the initial disappearance might be quantitatively related to the total blood flow rate to the liver. (auth)

4192 The Absence of Localization of Barbital in Divisions of the Central Nervous System. E. W. Maynert and H. B. Van Dyke. J. Pharmacol Expti. Therap. 98, 184-7(1950) Feb.

The view that barbital is excreted only as unchanged drug was confirmed by the use of barbital labeled with N^{15}. The concentration of the isotopic barbital was determined by mass spectrographic analysis in various parts of the brain of four dogs after doses ranging from 25 to 250 mg/kg body weight. No localization in a particular division of the central nervous system such as the diencephalon was present. 14 references. (auth)

4193 Deposition of P^{32} in Developing Drosophila. R. L. B. Irwin, J. W. T. Spinks, and T. J. Arnason. Can. J. Research 28, 137-42(1950) June.

Eggs of Canton special stock of Drosophila were hatched and larvae reared on medium containing P^{32}. Alternate radioautographed and stained sections were made of larvae, pupae, and adults. Deposition of P^{32} was found to be heavy in fat bodies, nervous structures, and in organs of digestion and excretion. Very high concentrations of P^{32} occurred in imaginal discs. Discharged materials and nuclei from fat bodies had much P^{32} in early pupal stages, the activity becoming concentrated at sites of organ differentiation in later pupae. In the adults, the gonads, the nervous system, and the digestive tract contained much P^{32}. (auth)

4194 The Effects of Lipotropic Factors on Phospholipid Turnover in the Plasma of Patients with Cirrhosis of the Liver, as Indicated by Radioactive Phosphorus. W. E. Cornatzer and David Cayer. J. Clin. Invest. 29, 542-51(1950) May.

This is an extension of a previous study (J. Clin. Invest. 29, 534(1950) May) to include 20 patients, all of whom had clinical and laboratory histories of portal cirrhosis, in order to determine whether there was a demonstrable change in the phospholipid turnover following therapy when patients were clinically improved, whether administration of a dose of 10 g of choline would have any demonstrable effect when the condition was acute, and whether the effect of the large dose, if present, would persist after clinical improvement. Complete clinical and laboratory data on all patients including tables and graphs of results of phospholipid determinations done by a method previously described are given and extensively discussed. The authors conclude that phospholipid turnover in these patients was within the lower limits of the range found for normals and did not increase even when clinical improvement was pronounced; in 7 out of 8 patients in the acute condition the dose of choline increased the plasma phospholipid synthesis significantly, although this effect was not seen in the same patients after an interval of therapy. They further conclude that the stimulating effect of the lipotropic substances is evident only when the supply of choline or its precursors is insufficient, so that a test dose of lipotropic substance may be indicative of a relative insufficiency of these substances.

4195 Effect of Resorcinol on the Thyroid Uptake of I^{131} in Rats. I. Doniach and Russell Fraser. Lancet 1, 855-856(1950) May 6.

Adult rats weighing 150 to 250 g (mostly females of the hooded Lister strain) were injected intraperitoneally with 10 cc of I^{131} along with 0.5 μg of carrier potassium iodide and were sacrificed 1.0, 1.5, and 2 hr later; the radioactivity in the alkaline digest of the dissected thyroid glands was then determined. Radioautographs were made on other rats 2 hr after an intraperitoneal injection of 18 μc of the isotope. The antithyroid effects of 4-methyl-2-thiouracil, sodium thiocyanate, and resorcinol were measured in separate experiments; a subcutaneous injection of the particular drug to be studied was made 10 to 30 min before the administration of the I^{131}, the injection sometimes being repeated 1 hr later; the results were compared with the thyroid uptake seen in controls. Resorcinol effects were found to be similar to those of methyl thiouracil in all respects tested, that is, the maximal depression of thyroid uptake of iodine which can be induced, the abolition of organic binding as evidence by radioautographs, and the enhancement of its antithyroid effect obtainable by the additional injection of thiocyanate but not of methyl thiouracil.

4196 Excretion and Distribution of $Carbon^{14}$ During and Following Continuous Intraperitoneal Injection of $Carbon^{14}$ as Sodium Carbonate. Wallace D. Armstrong and S. H. Zbarsky. Metabolic Interrelations, Trans. 1st Conf., 67-71(1949).

The distribution of C^{14} in continuous injection was similar to that after a single intraperitoneal injection, although a somewhat larger fraction was taken up by the tissues; the device used for continuous injection of rats is described briefly.

4197 Fundamentals of Radiation Chemistry. W. F. Libby. Chicago Med. School Quart. 11, 81-6(1950) Apr.

A general discussion is presented on some fundamental concepts of radiation chemistry. The nature and characteristics of α, β, and neutron radiation are described. The types of instruments used for an analysis of the radiations are briefly outlined; these include Geiger counters, ionization chambers, and photographic emulsions. The role of such isotopes as I^{131}, C^{14} and tritium in tracer investigations and other forms of biological research are pointed out. Mention is made of an Atomic Energy Commission project to grow certain radioactive plants and farm produce.

4198 Implications of Atomic Energy in Medicine and Dentistry. I. Radioactive Isotopes as Research Tools. D. Harold Copp. Oral Surg. Oral Med. Oral Path. 3, 598-605(1950) May.

An elementary exposition is presented of the essentials of the nature of radiation from radioactive isotopes including a table of examples which gives the half-life, type of radiation emitted, safe tolerance doses, cost, and important uses. The use of radioisotopes as tracers, health physics, method of procurement of isotopes, and basic tracer techniques, such as in vivo studies, in vitro studies, simple absorption-distribution-excretion studies, complex metabolic studies, and radioautography, are briefly discussed.

BIOLOGY AND MEDICINE

4199 Implications of Atomic Energy in Medicine and Dentistry. II. Applications in Clinical Medicine. D. Harold Copp. Oral Surg. Oral Med. Path. 3, 606-12(1950) May.

Special problems encountered in the clinical use of radioisotopes concerning the safety of the patient and attendants are presented. After a short description of the meaning of safe tolerance doses, the following radioactive isotopes are considered separately in terms of the history of their use, their specificity, their applications, and general remarks about their applicability: P^{32} for the treatment of leukemia, polycythemia vera, and superficial skin tumors, and for tagging red blood cells; I^{131} for the study, diagnosis, and treatment of thyroid diseases, especially cancer and hyperthyroidism, and as a tag for diiodofluorescein and plasma; Na^{24} in the study of extracellular fluid, circulation times and circulation abnormalities, absorption across various membranes, and as a possible source of radiation in the therapy of chronic leukemia; Fe^{55} and Fe^{59} for the study of iron metabolism, absorption, and for the tagging of erythrocytes; Au^{198} in colloidal forms for the treatment of leukemia and for the infiltration of tumors especially of the cervix uteri; Co^{60} as a substitute for radium in needles and other applicators; Sr^{89} for the therapy of osteogenic sarcoma and secondary metastases to bone tissue. The author concludes that the use of isotopes involves special hazards and should be restricted to individuals with proper training in properly equipped institutions.

4200 Implications of Atomic Energy in Medicine and Dentistry. III. Applications in the Study of Bones and Teeth. D. Harold Copp. Oral Surg. Oral Med. Oral Path. 3, 613-21(1950) May.

After a brief review of the properties of bone tissue, a description is presented of work utilizing P^{32}, Ca^{45}, $Sr^{85,89,90}$, C^{14} in the study of mineral exchange, general bone metabolism, parathyroid effects on bone, rickets, severe P deficiency, and specific uptake by osteogenic tissue. This is followed by a brief discussion of the deposition of plutonium and fission products in bone and their elimination; among those considered are radiostrontium, radium, rare earth metals, uranium, radioyttrium, neptunium, radiocerium, americium, and curium. The author concludes that radioisotopes open new possibilities for research on bones and teeth in the study of the limited metabolic activities and mineral exchange, and in the study of dental problems such as fluorosis, caries, root resorption, periodontal disease and the effects of endocrine and nutritional disturbances.

4201 The Incorporation in Vivo of the Ethyl Carbon of Ethionine into Creatine and Choline of Rat Tissues. Jakob A. Stekol, Kathryn Weiss, and Sidney Weiss. J. Am. Chem. Soc. 72, 2309-10(1950) May (Communication to the editor).

Data are reported to show that the ethyl group carbon of ethionine tagged with C^{14} in the methylene carbon of the ethyl group appears in the creatine and choline of rat tissues. After intraperitoneal injection of 10 mg of the tagged ethionine (total activity of 3.72×10^6 cts/min) into each of two adult female Wistar rats, the animals were maintained for six days on a casein diet, were fasted for two days, and then sacrificed. Choline was isolated from the whole carcass as

BIOLOGY AND MEDICINE

choline reineckate which was converted to choline chloroplatinate for assay, after which it was further degraded to trimethylamine, isolated as the hydrochloride. The data includes the specific activity of the compounds mentioned and of creatinine potassium picrate. In subsequent experiments to verify the possibility that the de-ethylation of ethionine may proceed by the formation of ethanol which would on oxidation lead to the formation of acetic acid, 10 mg of tagged ethionine was injected intraperitoneally into two adult rats which were maintained on a complete casein diet supplemented with S-benzyl-L-cysteine; urine was collected for three days and from this was isolated pure N-acetyl-S-benzyl-L-cysteine with a specific activity of 1.84×10^4 cts/min/mM.

4202 Influence of Lansing Virus Infection on Phosphorus Metabolism of Monkey Brain Tissue. John A. Anderson, Carl Gemzell, Louise Gemzell, Vern S. Bolin, and Leo T. Samuels. Proc. Soc. Exptl. Biol. Med. 73, 690-2(1950) Apr.

Young, conditioned, healthy rhesus monkeys were given a single intracerebral inoculation of Lansing poliomyelitis virus. Both control and virus inoculated animals were sacrificed at 12, 24, 48, 72, 96, 144, 168, and 192 hr following the inoculation, and 50 min before sacrificing about 1 mc of P^{32} was injected intravenously in the form of an inorganic salt (NaH_2PO_4). The brain, brain stem, and cord were removed rapidly and aseptically after sacrifice for analysis of the content of acid soluble phosphate compounds, determination of the specific activity of these phosphate compounds, pathology, and viral assay. It was found that coincident with the development of viral growth and earliest pathology in the inoculated monkeys, there appeared to be a marked increase in the metabolic activity of these tissues in regard to the phosphate ion. This increase in metabolic activity of the affected brain stem tissues and spinal cord continued to increase during and throughout the period when clinical evidence of weakness, paralysis, and neurologic signs of clinical poliomyelitis existed.

4203 Longitudinal Migration of Phosphorus in a Sensory Nerve after Stimulation. Gilbert Causey and Gerhard Werner. Nature 165, 762(1950) May 13 (Letter to the editor).

The difference between the longitudinal distribution of radioactive phosphorus in the sural nerve of rabbits at rest and in activity has been described in previous work (Nature 165, 21(1950)); this communication is a discussion of the demonstration of a similar redistribution of the total phosphorus in isolated nerves. The series of experiments were performed on 11 nerves assayed immediately after cutting and on 11 nerves which were allowed to stand in solution or at the site of the cut for 30 to 130 min. A maximal difference in P^{32} concentration between the distal and proximal ends of the cut nerve was found after 30 to 40 min. The authors conclude that the distribution is radically changed by the stimulation in vitro and that the direction of the change is set, not by the direction of propagation of the impulse, but by some inherent organization of the fine structure of the nerve.

4204 Maternal Plasma as a Source of Iron for the Fetal Guinea Pig. Gilbert J. Vosburgh and Louis B. Flexner. Am. J. Physiol. 161, 202-11(1950) May 1.

BIOLOGY AND MEDICINE

In order to assess the theory that radioiron in the fetal circulation is derived from maternal plasma, experiments were performed on the mothers and fetuses of the guinea pig during the last half of pregnancy. The experiments involving 55 animals and their fetuses are completely described, tabulated, and discussed; the authors conclude that the fetus does not derive iron from maternal red blood cells during the latter half of pregnancy.

4205 Measurement and Localization of an Unknown Dose of Radioactive Iodine in Thyroid Tissue. Egilda De Amicis, Kathryn H. Haley, and Russell F. Cowing. Am. J. Clin. Path. 20, 443-5(1950) May.

A patient who had been referred to the Lahey Clinic for surgical removal of the thyroid presented a history of having received a tracer dose of radioiodine at an unknown time, date, and in an unknown amount. The method of determining these unknown facts after extirpation is described; the amount determination was estimated by means of the absolute β counting technique and the localization in the thyroid tissue was shown by a radioautograph.

4206 Passage of Radioactive Erythrocytes from the Peritoneal Cavity into the Blood Stream During Experimental Ascites. Frank W. McKee, and Wellington B. Stewart. J. Exptl. Med. 91, 599-605(1950) June 1.

Intraperitoneal injection of red cells tagged with radioiron into dogs with experimental ascites demonstrated that such cells were rapidly transferred into the circulating blood. When the experimental animals were not actively producing ascitic fluid, 43.4, 67.0, and 56.4%, respectively, of the administered radioactive red cells passed to the blood in 72 hr. In the same 3 dogs during active ascitic fluid formation, 25.9, 51.2, and 38.8% of the administered radioactivity was removed in a similar period. The amount of radioactivity in the blood stream, consequent to the passage of red cells from the peritoneal cavity into the circulation, becomes nearly constant in 48 hr, whereas for radioactive plasma proteins the plateau is attained in 24 hr. In normal dogs the passage of red cells from the peritoneal cavity was complete in 72 hr, while in ascitic dogs, 5 to 47% of the injected tagged red cells remained behind in the peritoneum after the same period. 20 references. (auth)

4207 Permeability in Relation to Nerve Function. II. Ionic Movements Across Axonal Membranes. M. A. Rothenberg. Biochim. et Biophys. Acta 4, 96-114 (1950).

Nerves of squid were bathed in artificial sea water containing radioactive ions; the axoplasm was then extruded and its radioactivity was determined. Ten percent of the K in the resting fiber was to be replaced by K^{42} within 60 min when all the K of the bathing medium was K^{42} (0.013M), and about 20% of the K of the axoplasm was exchanged in the same time with 0.026M K^{42} outside. An equilibrium of the K was established after about 50 min in both cases. All the Na in the axoplasm was exchanged for Na^{24} in 30 min, the initial rate of exchange of Na being many times greater than that of K. Values of the uptake of Ca^{45} are given. When the nerves were stimulated by condenser-discharge shocks at a rate of 100 times/sec, the rate of exchange of Na was 67% higher than in the resting fiber. The temperature coefficient (Q_{10}) for the rate of penetration is 1.22 for K and 1.33 for Na. No important energy-yielding chemical reactions were involved in the exchange of Na and K across the nerve membrane at rest. Di-isopropyl fluophosphate and eserine decreased the K penetration and increased the Na penetration into the fiber. The influence of x-ray irradiation on the permeability to Na was also studied.

4208 Phosphorus Uptake by Bacteriophage and Ultraviolet Irradiated Bacteria. Louis W. Labaw, Vernon M. Mosley and Ralph W. G. Wyckoff. Exptl. Cell Research 1, 353-4(1950) Apr.

Culture of E. coli, exposed to a dose of unfiltered radiation from a quartzmercury lamp sufficient to reduce the developable colony count by a factor of 100,000, are shown to exhibit a steadily diminishing uptake of P^{32} which is at all times less than that of a non-irradiated culture. After addition of enough of a Berkefeld filtered broth suspension of bacteriophage to irradiated suspensions in order to infect all susceptible bacteria, a P^{32} uptake was found which is several times greater than the uptake for the irradiated bacteria alone. This stimulation of the phosphorus anabolism in the irradiated bacteria-bacteriophage system is in striking contrast to conditions observed in similar non-irradiated systems. The uptake graphs are given; the authors conclude that the results recorded indicate the synthesis of desoxyribose nucleic acid from the phosphorus of the medium.

4209 Presence of Iodinated Amino Acids in Unhydrolyzed Thyroid and Plasma. J. Gross, C. P. Leblond, A. E. Franklin, and J. H. Quastel. Science 3, 605-8(1950) June 2.

In order to confirm, by means of a paper chromatography, the discovery that the only compound of low molecular weight found in unhydrolyzed thyroid extract is thyroxine, and to study the production of other iodinated amino acids which might be formed during the breakdown of thyroglobulin, the appearance of these substances has been studied by means of observation of their presence in n-butanol extracts of plasma, and, by chromatographic analysis of whole plasma, evidence as to the nature of the circulating thyroid hormone has been supplied. Details of the experiment are given in which female albino rats, maintained on Remington's low iodine content diet No. 342, were injected subcutaneously with about 100 μc of carrier-free radioactive NaI^{131} and, after 48 hr, were anesthetized with ether and exsanguinated with a heparinized syringe via the inferior vena cava. It was concluded from this study that thyroxine, after its release by the thyroid gland, circulates in combination with plasma proteins. The complex thus formed can be split with butanol and reconstituted in vitro.

4210 Proceedings of the Physiological Society, 16-17 December 1949. J. Physiol. (London) 3, 10P-20P (1950) Apr. 15.

Among the papers presented were the following: The Effect of Stimulation on the Exchange of Radioactive Phosphorus in Peripheral Nerve, F. Grande and D. Richter; Some Antigen-Antibody Reactions Studied with the Aid of Radioactive Isotopes, T. E. Banks, G. E. Francis, W. Mulligan, and A. Wormall. In the first paper, experiments are described utilizing the sciatic nerve of frogs; after the nerve was injected with P^{32}, it was suspended in Ringer solution contain-

ing 0.1% glucose and oxygenated with O_2 + 5% CO_2; there was a slow loss of the P^{32}, which was not greatly affected by stimulation of the nerve or by the addition of sodium glutamate to the Ringer solution; phosphate ions could pass from the Ringer solution into the nerve, and this rate of uptake was greatly increased by nerve stimulation (200%). The authors consider it likely that the process may regulate the normal potassium content of the nerve. In the second paper the results of the investigation of the precipitin reaction between various antigens and their antibodies studied quantitatively with the aid of antigens labeled with P^{32}, S^{35}, or I^{131} and antibodies labeled with S^{35} or I^{131}. Evidence for the presence of antibodies capable of reacting with phospholipids has been obtained in experiments with the lipovitellin-antilipovitellin system. Other results are given.

4211 Radioactive Isotopes and Their Application in Biology and Medicine. C. Lombroso. Minerva pediatrica 1, 27-37(1949)(in Italian).

A comprehensive review of most of the work done with the aid of isotopes in the field of biochemistry and medicine, with critical evaluation of the results achieved is presented. Special attention is devoted to problems of intermediate metabolism of protein, iron, phosphorus, iodine, and calcium. One chapter evaluates the therapeutic properties of radioactivity, where the author advises special caution in accepting claims that have not yet been substantiated; another chapter evaluates the therapeutic properties of radioactive isotopes to problems of pathology and histology. In order to give a practical example of when the use of radioactive isotopes can best serve the investigator, the author in the last chapter briefly outlines some personal work done with radioactive sodium and potassium isotopes in studying problems of electrolyte physiopathology.

4212 Radioactive Isotopes in the Study of Iron Metabolism and in Human Therapy. Alfredo Vannotti. Rend. ist. super. sanità 12, 595-607(1949).

One and a half hours after intravenous injection into rabbits of Fe^{59} ferrous lactate the activity is distributed as follows: Blood 26% (mostly in the plasma), liver 41%, spleen 0.6%, kidney 4%, intestines 7%, muscle 7%, bone 4%, skin 9%. After several days the activity of the blood is found mostly in the red corpuscles (hematin), while the activity of the skin, muscle, kidney, and intestines becomes insignificant. The distribution of ferric lactate is initially slightly different but it subsequently becomes equal to that of Fe^{++}. In rabbits with chronic anemia the percentage distribution after 1.5 hr is as follows for Fe^{++} and Fe^{+++}, respectively: Blood 37 and 41, liver 25 and 21, spleen 0.19 and 0.16, kidney 1.4 and 8, intestines 6 and 0.7, muscle 9 and 1.5, bones 19 and 24, and skin 1 and 1. In a healthy rabbit at an O_2 pressure corresponding to 7000 m altitude the Fe distribution in the organs cited in the same order as before is: 31, 23.5, 0.34, 2, 5, 14, 12, and 9%, respectively. In Pb-intoxicated rabbits the Fe circulating in the blood is distinctly lower while a concentration occurs in the bone marrow. Apparently the Fe cannot be used for the hemoglobin synthesis in this case. The Fe in erythroblasts is found in the cytoplasm rather than the nucleus. The synthesis of hemoglobin probably occurs in the cytoplasm. The synthesis of hemoglobin is more rapid than that of cytochrome c and that of myoglobin. Normally there is no renal elimination of Fe except in cases of excessive Fe

in circulation. Some of the therapeutic applications of radio-P and radio-I are reviewed.

4213 Radioactive Tracers in Antisera. F. D. S. Butement. J. Chem. Soc. (London) 1949, Suppl. No. 2, 408-10.

It has been found possible to introduce I^{131} into the globulin fraction of an antiserum without destroying its specific agglutinating properties, if the mean number of iodine atoms per globulin molecule is limited to about 3. With greater amounts of iodine there is a gradual falling off of antiserum agglutinating activity, owing to substitutions in the tyrosine residues, and oxidation of the globulin. The amount of iodine radioactivity carried on bacteria (Proteus vulgaris) when agglutinated by the specific antiserum can be used to measure the amount of agglutinin in the serum. (auth)

4214 Recent Use of Radioactivity in Biology. L. F. Bélanger. L'union méd. Can. 78, 533-7(1949)(in French).

A brief survey of recent literature on the biological effects of the atomic bomb and on the medical therapeutic application of radioactive isotopes, including radioactive iodine, phosphorus, iron, and sodium is presented. Recent antographic methods for the detection of radioactive isotope concentrations in tissues are discussed.

4215 Studies on the Excretion and Distribution of Radioactive Calcium. R. I. Lienke, George Cullen, and Wallace D. Armstrong. Metabolic Interrelations, Trans. 1st Conf., 73-6(1949).

The fate of Ca^{45} was followed during and after the continuous intraperitoneal injection of $Ca^{45}Cl_2$ in rats. Absorption from the peritoneal cavity was incomplete; significant amounts of Ca^{45} were excreted in the feces. Of the tissues, the skeleton retained by far the largest amount of Ca^{45}.

4216 Studies with Radioactive Penicillin. S. Rowlands, D. Rowley, and E. Lester Smith. J. Chem. Soc. (London) 1949, Suppl. No. 2, 405-7.

Penicillin labeled with S^{35} has been prepared by growing the mold on a medium containing a low concentration of inorganic sulfate as the only source of sulfur. A high conversion of sulfur into penicillin was achieved, making it possible to detect as little as 0.002 International Unit by measuring the radioactivity. By this method penicillin can be detected in small concentrations at hitherto inaccessible sites. The product has been used to measure the amount of penicillin taken up by sensitive bacteria and to trace the fate of penicellin when administered to experimental animals.

4217 Synthesis of Sulfur Amino Acids from Inorganic Sulfate by Ruminants. Richard J. Block and Jakob A. Stekol. Proc. Soc. Exptl. Biol. Med. 73, 391-3 (1950) Mar.

Radioactive sodium sulfate, labeled with S^{35}, was fed to a cow, milk was collected, and its proteins isolated. Filter paper chromatograms showed the activity to be in the cystine and methionine bands, indicating synthesis of these compounds from inorganic sulfate sulfur.

4218 Transfer of Radioactive Phosphorus to Pine Seedlings by Means of Mycorrhizal Hyphae. Elias Melin and Harald Nilsson. Physiologia Plantarium 3, 88-92(1950).

BIOLOGY AND MEDICINE

In preliminary experiments, the transport of P^{32} through mycorrhizal hyphae was studied by allowing the hyphae to grow over the edges of a small cup placed in a petri dish, after mycelia from pure cultures of various Hymenomycetes, forming mycorrhizae with pine had been introduced into the dishes; an acid solution of P^{32} was placed in the cups and the activity of the mycelium on the agar was measured. It was found from these experiments that it was possible for fungus hyphae to grow over a barrier of glass to a considerable height; the hyphae transported P^{32} in measurable quantities, which were proportional to the distance from the P^{32}-source. In the main experiments, a somewhat similar technique was used; a cup was placed in an Erlenmeyer flask and both were partially filled with sand and a nutrient solution. One aseptic seedling of Pinus silvestris L. was introduced into the flask and after four months, the cups were inoculated with mycelium of Boletus variegatus; after the hyphae had overgrown the cup lip, P^{32} in a solution was added to the cups (with activities of 1 μc to 1 mc) and after varying periods of exposure (a few hours to a few days) the experiments were stopped and the activities of the seedlings measured. From these experiments it was found that in pine seedlings the nonmycorrhizal tips of the main and of the lateral roots contained very small amounts of P^{32}, whereas segments bearing mycorrhizae contained considerable quantities. It was demonstrated that Boletus variegatus (Sw.) Fr., as fungal symbiont, is able to transfer phosphorus to the pine roots.

4219 Transmural Migration of Intestinal Bacteria. Fritz B. Schweinburg, Arnold M. Seligman, and Jacob Fine. New Eng. J. Med. 242, 747-51(1950) May 11.

A method for preparing radioactive Escherichia coli with radioactive iodine is described. Direct evidence of transmural migration of Escherichia coli from the gut as a result of prolonged chemical irradiation of the peritoneal cavity of the dog was provided by means of organisms tagged with radioactive iodine. Migration occurred with dead as well as with live bacteria. Invasion of the inflamed peritoneal cavity via the circulating blood was found to be insignificant. (auth)

4220 The Uptake of Radioactive Phosphorus by Influenza Virus A (PR8 Strain). A. F. Graham and Laurella McClelland. Can. J. Research 28E, 121-34(1950) June.

A similar article by the authors appeared in Nature 163, 949(1949) June 18. It was listed in Nuclear Science Abstracts as Abstract 3-625.

4221 The Use of the Nitrogen Isotope Nitrogen[15] in Field Studies with Oats. W. V. Bartholomew, L. B. Nelson, and C. H. Werkman. Agron. J. 42, 100-3(1950).

Agronomy field experiments were carried out on oats with $(NH_4)_2SO_4$ labeled with N^{15} as the fertilizer. The fertilizer N comprised 4.7 to 17.9% of the total N in the plant, and the recovery of the N from the fertilizer ranged from 11.0 to 29.3%. The percentage of total N in the plant coming from the fertilizer was greater from 40 lb of N per acre than from 20 lb. A smaller percentage of the fertilizer N was recovered from the 40 lb rate than from the 20 lb rate. The order of fertilizer N recovery relative to the time of application was as follows: at seeding > grass stage > boot stage. Dry weather probably reduced the amount of uptake and recovery. This type of research and its problems are discussed.

BIOLOGY AND MEDICINE

4222 Use of Radioactive Isotopes in Chemical and Biological Research. M. Guillot. Rev. gen. sci. 56, 168-76(1949)(in French).

Brief review of the method of production of artificially radioactive isotopes, and a short comment on their use in chemical and medical research are presented.

CHEMISTRY

4223 The Chemistry and Metallurgy of Miscellaneous Materials. Thermodynamics. Laurence L. Quill. New York, McGraw-Hill, 1950. 329 p. NNES Div. IV, Vol. 19B.

The papers which make up this book include surveys on the thermodynamic and physical properties of the elements and of many of their compounds. Special emphasis is given to their halides, but carbides, sulfides, silicides, and phosphides are also treated. The final paper reports measurements of the heat of reaction of the Ce^{+4}-Ce^{+3} couple in perchloric acid. The correlation between the individual papers in this volume and the respective U. S. Atomic Energy Commission declassified or unclassified documents is found in the Published Documents Index of this issue.

4224 On the Catalytic Properties of Element 84 (Polonium-210). P. Bonet-Maury and M. Lefort. J. Chem. Soc. (London) 1949, Suppl. No. 2, 322-3.

Evidence is presented for the catalytic action of radioactive Po^{210} on the decomposition of H_2O_2. While the rate of decomposition of the H_2O_2 between 20 and 60 μg/cc is slightly lower using polonium than it is using platinum as a catalyst, the range of catalytic activity of polonium is much wider; it is shown to have a slight effect down to 10^{-7} μg/cc. The catalytic action was found to be due to the element rather than its radioactivity.

4225 Chromatographic Analysis. Discussions of the Faraday Society, No. 7 (1949). London, Gurney and Jackson, 1949. 336p.

This entire issue is devoted to the theoretical and practical aspects of chromatography. The papers fall under three main headings as follows: I. Physicochemical principles and their utilization, II(A). Inorganic applications, and II(B). Organic and biochemical applications. One of those in II(A), by Frank H. Spedding, describes the large-scale separation of the rare earths as developed at the Ames Laboratory of the Atomic Energy Commission.

4226 The Determination of Radon and Radium in Water. R. B. Jacobi. J. Chem. Sci. (London) 1949. Suppl. No. 2, 314-8.

The scheme here described for radon and radium analysis was devised as a compromise between the opposing aims of simplicity and convenience of working on the one hand, and a high order of sensitivity of measurement on the other. The latter arose from the expectation that the waters to be analyzed would generally contain appreciably less than a $\mu\mu$g of radium per liter, and, as it was not desired to handle water samples of a volume greater than 1 to 2 liters, equipment was required which would measure activities of the order of 0.1 $\mu\mu$-curie. The experimental procedure involves the separation of the radon dissolved in the water sample and its transference to the ionization chamber for measurement, and the concentration of the radium into a solution of small

bulk, from which the radon may be allowed to accumulate, the radium being estimated by measuring the amount of radon so obtained. (auth)

4227 Techniques in Radiochemical Assay with Geiger-Mueller Counters. G. B. Cook and J. F. Duncan. J. Chem. Soc. (London) 1949, Suppl. No. 2, 369-81.

Some of the errors possible in measuring β-active material with G-M counters are discussed in some detail. Emphasis has been laid on aspects not fully considered elsewhere, such as errors due to bad sample mounting. Errors in liquid-immersion counting and in flow counters are also discussed.

4228 Concerning Titanium Selenide and Telluride. Paul Ehrlich. Z. Anor gan. Chem. 260, 1-18(1949) Oct. (in German).

Titanium selenide and telluride were artificially prepared in the concentration range $AB — AB_2$. These preparations were studied by x-ray, pycnometric, and magnetic means. In both systems a homogeneous transition from a NiAs lattice to that of CdI_2 was found, with initial and final lattice constants as follows:

$TiSe$: $a = 3.55_8$ A, $c = 6.22_0$ A, $c/a = 1.74_8$

$TiSe_2$: $a = 3.54_1$ A, $c = 5.98_2$ A, $c/a = 1.69_0$

$TiTe$: $a = 3.83_4$ A, $c = 6.39_0$ A, $c/a = 1.66_8$

$TiTe_2$: $a = 3.75_7$ A, $c = 6.51_3$ A, $c/a = 1.73_4$

The lattice constant for the a-axis went through a maximum at the composition $AB_{\sim 1.2}$ and that for the c-axis through a minimum.

4229 Distribution of Radium Between Crystals of Lanthanum Fluoride and Its Saturated Solution in 3% Nitric Acid at 100°C. V. G. Khlopin and M. S. Merkulova. Doklady Akad. Nauk S. S. S. R. 71, 689-91(1950)(in Russian).

This work is one in a series on the formation of mixed crystals from solutions containing a component which is present in very small quantities. However, the main purpose of the study is the formulating of criteria for the discrimination between the several types of isomorphism, as distinguished by Grimm and Goldschmidt. According to the authors' theory, only "true" isomorphic crystalline substances are miscible in all proportions; in the other kinds of isomorphism, there exist some limiting proportions below which the formation of mixed crystals is impossible. In the former case, the coefficient of the distribution of the microcomponent between the solid and liquid phases, (the crystallization coefficient), is constant; in the latter case, it decreases rapidly with the concentration of the microcomponent in the solution. The experimental investigation of the system $YF_3 — CaF_2$ being difficult, it was replaced by that of the analogous pair $LaF_3 — RaF_2$. A wide concentration range was obtained by adding various quantities of the Ba salt to the Ra salt; (the legitimacy of such a substitution has been shown in Zhur. Fiz. Khim. 14, 941(1940)). Titrated suspensions of LaF_3 in 3% HNO_3 were mixed with saturated solutions to which a small quantity of $La(NO_3)_3$ had been added. Some of the suspensions had been prepared from a La salt containing Ra +Ba ("active suspensions"); similarly, some

of the saturated solutions contained Ra + Ba. Mixtures of active suspensions with inactive solutions, or mixtures of inactive suspensions with active solutions, were heated for 60 hr at 100°C. Recrystallizations, resulting in equilibrium distributions of Ra + Ba between the crystals and the solution, were thus obtained, at various total concentrations of $Ra^{+2} + Ba^{+2}$ ions in the solution. The crystallization coefficient fell rapidly from 18.2 at the total concentration 7×10^{-1} to almost zero at concentrations of the order 10^{-6} to 10^{-8}. This result confirmed the requirements of the theory regarding the position of the system $LaF_3 — RaF_2$ in the classification of isomorphous mixtures.

4230 A General Method for the Determination of the Composition and of the Molecular Structure of Chemical Compounds Present in Radiochemical, i.e. Imponderable, Quantities. V. G. Khlopin. Doklady Akad. Nauk S. S. S. R. 71, 901-3(1950)(in Russian).

Several rules concerning the limits of applicability of Mitscherlich's law of isomorphism have been formulated since 1929 by the author and his co-workers. According to this law, definite conclusions can be drawn concerning analogies in the chemical constitution of compounds that form isomorphous mixed crystals. Works of Grimm and of Goldschmidt (since 1921) have proved that, besides the true, or Mitscherlich's, isomorphous crystals, there exist other types of mixed crystals, formed by chemically unrelated compounds; however, no reliable criterion was found for distinguishing between the several types of isomorphism. By introducing the radioindicator technique and by placing to the foreground of the problem the co-crystallization of microcomponents, the necessary criteria, of first importance in the chemistry of carriers, were established by the author and his collaborators. True isomorphous mixed crystals can be obtained from solutions in which the concentration of one of the components is arbitrarily low, while in other types of isomorphism there exist definite concentration limits below which no mixed crystallization is possible. This can be interpreted by saying that, whereas in true isomorphism the replacements in crystal lattices take place atom by atom, in the other types the replacement proceeds by whole lattice cells. Mitscherlich's law, with its inferences concerning the chemical properties of elements and the composition of compounds, can be applied only to those cases, in which the distribution of the microcomponent (radioelement) between the crystalline phase and the solution strictly follows the laws of the distribution of substances between immixible solvents; in these (and only these) cases the distribution coefficient, i.e. the crystallization coefficient, is constant within a wide range of concentrations (several orders of magnitude). (Khlopin et al, Z. phys. Chem. 145A, 137(1929); Z. anorg. u. allgem. Chem. 172, 310(1928); Doklady Akad. Nauk S. S. S. R. 65, No. 6(1949); ibid. 71, No. 3 (1950); Nikitin et al., Izvest. Akad. Nauk, Otd. Khim. Nauk 6, 383(1942)).

4231 The Probability Distribution of X-ray Intensities. II. Experimental Investigation and the X-ray Detection of Centers of Symmetry. E. R. Howells, D. C. Phillips, and D. Rogers. Acta Cryst. 3, 210-14(1950) May.

The probability distributions of reflected x-ray intensities have been investigated experimentally. The results are in agreement with the theory, and the possibility is demon-

CHEMISTRY

strated of distinguishing between centrosymmetric and non-centrosymmetric structures and projections within the limitations of the theory. Details of a convenient distinguishing test are presented and the effects upon it of absorption, extinction, and experimental errors in intensities are discussed. 13 references. (auth)

4232 Some Electronic Properties of a One-dimensional Crystal Model. David S. Saxon and R. A. Hutner. Philips Res. Rep. 4, No. 2, 81-122(1949) Apr.

The Kronig-Penney model of a one-dimensional crystal is studied with the aid of the formalism of the Dirac δ-function. Both a Green's-function method and a scattering-matrix method are used to derive the energy levels and wave functions for the monatomic and the diatomic lattices. The scattering-matrix method is used to study the problems of a single impurity, both substitutionally and interstitially located, and the coupling between impurities. In the last section the general problem of a solid solution is discussed. (auth)

4233 Infrared Spectrometric Determination of Deuterium Oxide in Water. Vernon Thornton and F. E. Condon. Anal. Chem. 22, 690-1(1950) May.

The deuterium oxide content of deuterium oxide-water mixtures containing 3 to 100% deuterium oxide is determined with a precision of 1 part in 100 from the absorption of the 3.98-micron deuterium oxide band in the infrared absorption spectrum of a sample diluted with water so that the deuterium oxide concentration is in a measurable range. The percentage of deuterium oxide is read from a calibration curve. The time required for each determination is approximately 10 min. (auth)

4234 Isotope Effect in the Vibrational Frequency Spectra and Specific Heats of Sodium Hydride and Deuteride. Edward V. Sayre and Jacob J. Beaver. J. Chem. Phys. 18, 584-94(1950) May.

The prediction by the Born and von Karman lattice dynamics theory of the effect of isotopic substitution on crystal vibration frequencies has been determined by calculation of frequency spectra of sodium hydride and sodium deuteride. In each case 6690 of the lattice frequencies have been calculated with the aid of I.B.M. punched card computers. They have been chosen and weighed in such a way that the whole frequency spectra of the crystals are uniformly sampled. Both spectra exhibit acoustical branches which are nearly identical, and optical branches, the frequencies of which are essentially in the ratio of the square root of 2. In both cases, the optical branches extend somewhat uniformly over very broad ranges of frequencies, in marked contrast to the estimation of optical frequencies as a few monochromatic lines. The molar heat capacities of these two compounds have been determined experimentally between 60 and 90°K with an adiabatic calorimeter and compared to corresponding curves calculated from the frequency spectra. The theoretical and experimental sets of curves possess the same general form. In both cases the deuteride values are higher than the hydride values, with the curves of the two substances diverging with increasing temperature. The theoretical curves, however, are nearly uniformly displaced from the experimental curves by about 10%, an effect which could have arisen from an error in the repulsive force constants. (auth)

CHEMISTRY

4235 On the Kinetics of the Exchange Reaction Between Hydrogen and Deuterium Under the Action of Alpha Rays. W. Mund and M. Van Meersche. Bull. classe sci. Acad. roy. Belg. 36, 47-62(1950)(in French).

By application of the diffusion law it was possible to calculate the fraction of the reaction chains $H + D_2 \rightarrow HD + D$, $D + H_2 \rightarrow HD + H$, which reach the wall of a spherical reaction chamber containing a mixture $H_2 + D_2$ irradiated by a central source of α rays. The author concludes that an inhibiting mechanism, involving other molecules than those of the mixture $H_2 + D_2$, must act on this process in order for the theory to give correct numerical results.

4236 Photosynthesis of Deutero-Ethylene and Deutero Acetylene-Bromides. Joseph C. Jungers and Joris Verhulst. Acad. roy. Belg. Classe sci. Mém. 23(2), Paper 1578(1949). 44p. (in French).

This article describes a method of photochemical synthesis which has enabled the preparation of the complete isotopic series of deutero ethylene and deutero acetylene bromides as well as some of their derivatives: the deutero ethylenes, the tribromo deutero ethanes, and the deutero vinylidene bromides. The products of these syntheses have been identified by their Raman spectra. It has been possible to deduce from this study a certain amount of information on the mechanism and kinetics of these synthetic reactions. 15 references. (auth)

4237 A Simple Method for the Densiometric Determination of Heavy Water. Leo. A. Sapirstein. J. Lab. Clin. Med. 35, 793-4(1950) May.

A method is described for the determination of the density of deuterium oxide-water mixtures with an accuracy of 3 ppm with simple equipment by taking advantage of the fact that the specific gravity of an aqueous solution of deuterium oxide decreases more rapidly with temperature than does the specific gravity of a hollow Pyrex glass bead. The preparation of the bead is described; the bead is placed in a closed test tube with redistilled, air-free water, heated until the bead sinks, and the temperature is observed as the tube cools by means of a Beckman differential thermometer until the bead just breaks away from the bottom of the tube. These determinations are graphed for varying concentrations of the deuterium oxide from 0 to 2% showing that an increase of one part per thousand changes the end point temperature determination by 0.35°C; so that a 1% deuterium oxide solution can be determined with an accuracy of 0.3%. Some further remarks are made on the use of smaller beads and other thermometers.

4238 Photosensitized Reactions of Carbon Tetrafluoride. J. R. Dacey and J. W. Hodgins. Can. J. Research 28, 173-81(1950) May.

$H(g)\,(6^3P_1)$ at room temperature and at 300°C and $H(g)\,(6^1P_1)$ at room temperature are found to fail to react with carbon tetrafluoride at a measurable rate. $Xe(^3P_1)$ causes carbon tetrafluoride to decompose with a quantum efficiency of about unity, to yield fluorine and an unidentified solid product. It is concluded that the energy necessary to break the first C-F bond in CF_4 is more than 154 and less than 194 kcal/mole. H atoms produced from $H(g)\,(6^3P_1)$ at room temperature and at 300°C and from $H(g)\,(6^1P_1)$ at room temperature do not react with CF_4. It is concluded from this that the activation

CHEMISTRY

energy of the reaction $CF_4 + H \rightarrow CF_3 + HF$ is not less than 14 kcal/mole. (auth)

4239 Several Heterocyclic Compounds Containing Fluorine. Buu-Hoï, Hoan, and Pierre Jacquignon. Rec. trav. chim. 68, 781-8(1949) Sept.-Oct. (in French).

The synthesis and properties of a series of compounds derived from fluorobenzene is described. These are mainly nitrogenous heterocyclic substances (cinchoninic acids, quinolines, indoles, pyrrocolines, pyrimidazoles) prepared starting with 4-acylfluorobenzene and to be used for various biological studies, notably for research in carcinogenic properties or the eventual noxious action on liver tissue. (auth)

4240 Hydration of Neodymium Ions in Water-Alcohol Solutions. V. Rotshteïn. Doklady Akad. Nauk S. S. S. R. 71, 335-8(1950)(in Russian).

The energy liberated when an ion is introduced into a solvent cannot be determined experimentally; it is calculated by using a certain hypothetical model illustrating the interaction between the ion and the solvent. One of the most important components of this energy is the energy liberated during the formation of the "solvent sheath" around the ion; the number of molecules of the solvent in such a sheath is calculated by seeking the minimum potential energy of the complex formed. The author devised an experimental method permitting the determination of the "hydration number," i.e., the number of water molecules forming a sheath around the ion Nd^{+3}. The method is based upon the observation that the absorption spectra of rare earth salts are practically independent of the nature of the anion and of the presence of other ions, being determined solely by the nature of the solvent; thus, when water is added to an alcohol solution of $NdCl_3$, the line 4295 A, characteristic of alcohol solutions of that salt, gradually disappears and is replaced by the line 4273 A, characteristic of the water solutions; the intensity of the latter line reaches its maximum at the precise moment when the former line disappears; this is true for other lines, and a relatively small quantity of water suffices for the rearrangement of the spectrum. The phenomenon is interpreted as a replacement of the alcohol-molecule sheath around Nd^{+3} by a sheath consisting of water molecules; the number of the latter can then be computed from the equation for the equilibrium constant of the reaction, the concentrations of the hydrated Nd^{+3} being determined from the measured intensities of corresponding absorption lines, (see Bent et al., J. Am. Chem. Soc. 63, 565(1941)). Using this method, the author found that the hydration number of Nd^{+3} is 4, in disagreement with the usually accepted values 6 or 8 for trivalent monatomic ions. A special experiment showed that a simultaneous hydration of Cl^- cannot account for the discrepancy.

4241 Anion Exchange Studies. I. Separation of Zirconium and Niobium in HCl-HF Mixtures. Kurt A. Kraus and George E. Moore. ORNL-661, May 25, 1950. 21p.

The behavior of zirconium(IV) and niobium(V) on the anion exchange resin Dowex-1 has been studied in a number of HF-HCl mixtures by use of Zr^{95} and Nb^{95} as radioactive tracers. Radiochemical methods of assay were used. Separation of the two elements is excellent under a number of conditions. Although zirconium is usually eluted first, the elements can be eluted in reverse order under some conditions. Attempts have been made to interpret the data in terms of ionic species and their equilibria. In the case of niobium at least three species were observed in 9M HCl differing by two fluoride ions each. The first two species, existing at low fluoride concentration are probably oxygenated. 13 references. (auth)

4242 Acid-Base Reactions in Nonaqueous Media Applicable to Analytical and Radiochemical Separations. K. Starke. Can. J. Research 28, 225-33(1950) May.

Experiments have been performed to investigate whether the common acids formed by water can be replaced by solutions of proton donors in nonaqueous solvents for dissolving metals and oxides. Hydrogen chloride as proton donor and nitrogen compounds as solvents have been examined in particular. It has been found that molten hydrochlorides of some aromatic amines dissolve metals and oxides readily and at convenient temperatures. The advantages to be gained in analytical and radiochemistry by the use of such compounds instead of acids formed by water are discussed. (auth)

4243 The Extraction of Carrier-free ^{131}I from Pile-irradiated Tellurium. A. W. Kenny and W. T. Spragg. J. Chem. Soc. (London) 1949, Suppl. No. 2, 323-6.

A method is described for the production of I^{131} from pile irradiated tellurium. I^{127} and I^{129} are also formed, but they are stable or very long-lived. The amount of I^{131} is determined by analyzing its β-decay curve as compared with the internally converted electrons from Te^{127} and Te^{129}. The over-all yield is better than 90% by the following method: the irradiated tellurium is dissolved in the potassium dichromate and sulfuric acid, the resulting hydriodic acid is reduced with a minimum of oxalic acid, and the free iodine is distilled off.

4244 Preparation of Carrier-free ^{32}P from Pile-Irradiated Sulphur. Part I. Adsorption of ^{32}P on Ferric Hydroxide and Dialysed Iron. A. W. Kenny and W. T. Spragg. J. Chem. Soc. (London) 1949, Suppl. No. 2, 326-30.

The removal of radiophosphate on ferric hydroxide in alkaline solution, and on dialyzed iron in acid solution, has been investigated. On ferric hydroxide, the efficiency of adsorption of radiophosphate decreases with increase of pH from 10.5 to 13.0. The presence of sulfate ion has little effect on the adsorption. On dialyzed iron in the pH range 1.0 to 4.0 phosphate adsorption in the presence of sufficient sulfate to complete precipitation of the radiophosphate has been measured. The amount of phosphate adsorbed is decreased if the sulfate concentration is increased beyond the minimum required for precipitation of the dialyzed iron. This effect decreases markedly with increase of pH. Radiophosphate can be selectively adsorbed by dialyzed iron from solutions containing chromium and aluminum at pH 2.0. The relationship between concentration of radiophosphate and the amount of ferric hydroxide or dialyzed iron required for maximum recovery of radiophosphate has been determined. (auth)

CHEMISTRY

4245 The Solvent Extraction of Protoactinium. A. G. Maddock and L. H. Stein. J. Chem Soc. (London) 1949, Suppl. No. 2, 258-9.

The extraction coefficient for protoactinium from strong chloride solutions using various organic compounds is given. The effects of various compounds in increasing or decreasing the extraction coefficient are described.

4246 Microsyntheses with Tracer Elements. XX. The Synthesis of Ethyl Di(4-Hydroxycoumarinyl) Acetate (Pelentan) Labeled with C^{14}. C. Wayne Bills, Arthur Murray, III, and Anthony R. Ronzio. AECU-833, nd. 4p.

The synthesis of Pelentan requires two steps: (1) the condensation of 4-hydroxycoumarin with C^{14}-labeled glyoxylic acid and (2) the esterification of the resulting product with ethyl alcohol. This esterification step is necessary because the free acid is physiologically inactive. The procedure described here led to good yields of Pelentan with a specific activity of 0.005 mc/mg. The 4-hydroxycoumarin used was prepared by a modification of the procedure of Stahmann et al (Jour. Biol. Chem. 138, 522(1941)).

4247 Microsyntheses with Tracer Elements. XIX. The Oxidation of C^{14} Formaldehyde to C^{14} Sodium Formate. Arthur Murray III, and Anthony R. Ronzio. AECU-834, nd. 1p.

This is not an abstract; the document is reproduced below in its entirety.

A micro method for the efficient oxidation of C^{14} formaldehyde to C^{14} formic acid was desired. The method here described is based upon the work of Blank and Finkenbeiner (Ber. 31, 2979(1898)) and gives high yields of formic acid.

Experimental. A standard formaldehyde solution was prepared by diluting 6.5 ml of reagent grade 36 to 38% formalin solution with 2 liters of water. The resulting solution was standardized by digesting an aliquot portion with an excess of 4-hydroxycoumarin and weighing the dicoumarol formed.

To a 250-ml open beaker containing 50 ml of the formaldehyde solution (2.18 mM of aldehyde) was added from a buret 18.33 ml of 0.1250N NaOH solution (2.29 mM) followed immediately by 10 ml of "Superoxol." The aldehyde odor invariably disappeared by the time one-third of the peroxide had been added. The mixture after standing from 3 to 5 days no longer gave a test for peroxide with starch-iodide paper. The solution was then titrated with 0.1N hydrochloric acid using litmus indicator. After correcting for a blank, the results from three experiments were 98.2, 97.7, and 99.5% with an average conversion of 98.5%.

The conversion of aldehyde to formate when carried out at the temperature of boiling solution under reflux was low. Oxidation of formaldehyde to formic acid in acidic solution also gave low and varying results.

Summary. C^{14} labeled formaldehyde was converted to C^{14} labeled sodium formate in yields varying between 97.7 and 99.5%.

4248 Microsyntheses with Tracer Elements. XVII. The Synthesis of Oxalic and Glyoxylic Acids Labeled With C^{14}. C. Wayne Bills and Anthony R. Ronzio. AECU-835, nd. 6p.

Oxalic acid labeled with C^{14} has been prepared from C^{14}-labeled sodium formate by fusion with sodium hydroxide by the method of Semenor et al (State Inst. Applied Chem. (USSR) 31, 63(1937). Yields of 88 to 90% were obtained. Glyoxylic acid, an important intermediate in biologic processes and organic syntheses, was then prepared from the C^{14}-labeled oxalic acid by reduction with sodium amalgam (Mohrschulz, Z. Elektrochem. 32, 434(1926)) in yields of 86 to 90%. Optimum results were obtained at pH 1.5 to 2.0.

4249 The Total Synthesis of Linoleic Acid. Harry M. Walborsky, Robert H. Davis, and David R. Howton. UCLA-71, May 15, 1950. 18p.

Existing knowledge of the structure of linoleic acid is discussed, and the total synthesis of this physiologically important substance by the catalytic semihydrogenation of 9,12-octadecadiynoic acid (prepared in eight steps from such starting materials as hexamethylene iodide or bromide, acetylene, and 2-octynol) is described. This method serves to establish the structure of linoleic acid as cis,cis-9,12-octadecadienoic acid on a definitive chemical basis. 23 references. (auth)

4250 Biosynthesis of Radioactive Vitamin B_{12} Containing Cobalt^{60}. Louis Chaiet, Charles Rosenblum, and David T. Woodbury. Science 3, 601-2(1950) June 2.

Experiments are described in which radioactive vitamin B_{12} was synthesized by means of the fermentation of Streptomyces griseus using a broth to which had been added radiocobalt sulfate. Preliminary experiments were conducted to ascertain the feasibility of the method; subsequent experiments, using cobalt with a higher specific activity, permitted the isolation of about 0.5 mg of once-crystallized vitamin; larger scale fermentations were then conducted and about 100 mg of high purity, crystalline, radioactive vitamin was isolated, having an activity of about 0.25 μc/mg. The authors conclude that the use of Co^{60} of higher specific activities than that employed in this work may yield radioactive vitamin B_{12} of much higher specific activity than 0.25 μc/mg.

4251 The Microsynthesis of Some ^{14}C-Labelled Organic Compounds. W. J. Arrol and R. Glascock. J. Chem. Soc. (London) 1949, Suppl. No. 2, 335-8.

Carbon dioxide can be converted in high over-all yield into ethyl iodide on the 10- to 20-micromole scale, and on the same scale into ethylmagnesium iodide in moderate yield. C^*O_2 is heated over barium at 600° to form BaC_2^* which is then converted into $C_2^*H_2$. The acetylene is reduced to ethylene by a chromous chloride solution. The ethylene is heated with saturated hydriodic acid to form ethyl iodide ($C_2^*H_5I$) vapor which reacts with heated magnesium metal to form ethylmagnesium iodide ($C_2^*H_5 \cdot MgI$) with a high specific activity of C^{14}.

4252 On the Direct Production of Carrierless Organic Radiohalides. E. Glueckauf, R. B. Jacobi, and G. P. Kitt. J. Chem. Soc. (London) 1949, Suppl. No. 2, 330-5.

Direct production of carrierless organic radiohalides (methyl iodide, iodobenzene, methyl bromide) in the thermal column of a pile was generally successful in the case of simple compounds of not too long half-life. In the cases of radiohalogens of long half-life as Br^{82} (34 hours), only methyl bromide could be produced in sufficiently large yields utiliz-

CHEMISTRY

ing a method whereby the methyl bromide vapor is constantly removed from the reaction zone. Purification of the carrier-less halides by distillation and chromatographic separation does not seem to cause any difficulties. (auth)

4253 Preparation of Ethyl Acetate-2-C^{14} and n-Butyl Acetate-2-C^{14} Using Alkyl Phosphates. Gus A. Ropp. J. Am. Chem. Soc. 72, 2299(1950) May.

For the conversion of C^{14}-labeled sodium acetate samples to alkyl esters of acetic acid, the use of alkyl phosphates has been found to be somewhat superior to the use of the corresponding alkyl sulfates which boil slightly lower and are much less stable at temperatures near 200°. Sodium acetate-2-C^{14} was converted to ethyl acetate-2-C^{14} in 93% yield by heating to 170 to 220° with excess triethyl phosphate. The high purity of the ethyl acetate was indicated by its vapor pressure. Sodium acetate-2-C^{14} was converted in 82% yield to n-butyl acetate-2-C^{14} by heating at 140 to 220° with tributyl phosphate. That the n-butyl ester was of high purity was shown by dilution technique. A sample was diluted one hundredfold with C.P. n-butyl acetate, and the diluted ester was converted to pure N-benzylacetamide having essentially the specific activity calculated from the specific activity of the sodium acetate.

4254 The Synthesis of 3,3′-Methylene-C^{14}-bis(4-hydroxycoumarin). C. C. Lee, L. W. Trevoy, L. B. Jaques, and J. W. T. Spinks. Can. J. Research 28, 170(1950) April (Brief note).

The use of dicoumarol (3,3′-methylene-bis(4-hydroxycoumarin)) for the treatment of thrombosis lead to the conclusion that this compound labeled with C^{14} would be valuable for physiological investigations. The procedure is briefly given by which the dicoumarol is synthesized by the addition of an aqueous solution labeled formaldehyde-C^{14} to an excess of 4-hydroxycoumarin in the form of a saturated aqueous solution, which gave a formaldehyde yield of 70 to 75%. Calculations are given to show that the labeled compound should have an activity of 0.625 μc of β activity per mg, and measurements with the compound showed a specific activity of 6.0×10^4 cts/min/mg. Experiments are mentioned showing that the liver constitutes the target organ for the action of dicoumarol in mice and rabbits.

4255 Some Aspects of Isotopic Exchange Reactions. Elizabeth Rona. Acta Phys. Aust. 3, 418-21(1950).

In this short review some aspects of the applications of radioactive isotopes to the study of isotopic exchange reactions in solutions are discussed. In particular, the author concerns herself with electron transfer reactions and the catalysis and structural factors which speed up these reactions.

4256 Some Chemical Problems in the Use, as a Fumigant, of Methyl Bromide Labeled with ^{82}Br. F. P. W. Winteringham. J. Chem. Soc. (London) 1949, Suppl. No. 2, 416-20.

Br^{82} has been used to label CH_3Br in studies of its behavior as a fumigant. Methods of preparation and assay are indicated. Some data are presented to illustrate how isotope exchange between different compounds may vitiate the results of isotope dilution procedure.

CHEMISTRY

4257 The Removal of Plutonium from Laboratory Wastes. C. W. Christenson, M. B. Ettinger, Gordon G. Robeck, E. R. Hermann, K. C. Kohr, and J. F. Newell. AECU-836, nd. 2p.

The document is in abstract form; it is reproduced below in its entirety.

A study of the removal of plutonium from laboratory wastes was undertaken in order to obtain information upon which to base pilot plant design. The methods investigated have included: (1) co-precipitation with iron, aluminum, and other metal ions. (2) adsorption by various agents such as activated carbon, "Celite," kaolin, etc., and (3) removal by living biological floc (activated sludges).

The activated sludge process was indicated to require a three-stage countercurrent plant with the addition of organic food sources ahead of each stage in order to reduce the plutonium content of the effluent to the desired level. The adsorption agents studied all removed plutonium with a fairly high degree of efficiency, activated carbon being the best of a number of materials studied. Effective adsorption was found to require a protracted period of contact. In order to obtain the desired plutonium removal without creating a new problem in the form of a large amount of contaminated adsorption agent, split treatment with long periods of mechanical agitation was indicated as being required.

In the absence of substantial amounts of organic complexing agents, the co-precipitation treatment appeared to be the simplest, cheapest, and most efficient. Because its efficiency was less subject to variation at different pH values, an iron floc was deemed to be preferable to an alum floc. The amount of iron required for the treatment was quite nominal, 10 ppm of $FeCl_3$ with sufficient lime added to bring the pH above 7 being adequate to produce the desired plutonium removal.

An occasional grab sample of waste was found which did not respond to the treatment with iron and lime outlined above. However, these were rare, and it was evident that the interfering materials in these samples would be diluted to innocuous levels by equalizing tanks. Samples composited from multiple grab samples were invariably treated successfully.

4258 The Lower Valency States of Thorium. J. S. Anderson and R. W. M. D'Eye. J. Chem. Soc. (London) 1949, Suppl. No. 2, 244-8.

The possible existence of compounds of bivalent or tervalent thorium has some current interest in relation to the position of thorium in the Periodic System, and the so-called "actinide" theory of the heavy elements. Such compounds might indicate whether unutilized valency electrons are disposed in the cerium-like (5f) or the zirconium-hafnium like (6d) configuration. Thorium di- and tri-iodide were prepared and found to be deeply colored compounds, analogous in every respect to the lower zirconium and hafnium iodides. They are formed by reduction of the tetraiodide with varying quantities of metallic thorium at 450 to 550°C. The tri-iodide is perceptibly volatile; it undergoes reversible dissociation to tetra- and di-iodide at 550 to 600°C. Above 600°C, both lower iodides disproportionate into the tetraiodide and metallic thorium. The compounds are hygroscopic and react vigorously with water, forming a thorium(IV) salt and

hydrogen equivalent to the reducing power. A complete analytical balance sheet can thereby be obtained, the Th:H ratio characterizing the product and the Th:(H + 1) ratio (ideally 4) serving as a check on the unavoidable side reaction of thorium tetraiodide with the glass. The two compounds have been unambiguously identified in this way, although not isolated completely free from each other. The compounds have been further characterized by their x-ray diffraction patterns. The di-iodide has been found to have a hexagonal layer-lattice structure, related to the C6 type, with a = 4.13 and c = 7.02 A. (auth)

4259 The Making of the Elements 97 and 98. F. A. Paneth. Nature 165, 748-9(1950) May 13.

The author describes briefly the experimental technique used in the production of elements 97 and 98 and discusses, in some detail, the radiochemical methods by means of which the identity of these elements was established. The similarity in chemical properties of the transuranic elements makes it impossible to prove the presence of a new transuranic element by a qualitative chemical reaction specific for this particular element. Recently, however, new separation methods have been developed, methods based on the adsorption and desorption of the element in question on specially prepared resins. These methods are very sensitive and have been used by Seaborg to identify new elements. This paper also treats the chemical properties of the elements 97 and 98 and their relations to other elements in the periodic table.

4260 A New Valency of Protoactinium. G. Bouissieres and M. Haissinsky. J. Chem. Soc. (London) 1949, Suppl. No. 2, 256-8.

The reduction of protoactinium salts by means of zinc amalgam is described, and experiments on the product suggest that it is in the quadrivalent state. (auth)

4261 Oxidation States of the Rare-earth and Actinide Elements. Robert E. Connick. J. Chem. Soc. (London) 1949, Suppl. No. 2, 235-41.

The existence of a wide variety of oxidation states and the ease of oxidation to higher states of the actinide elements compared with the rare-earth elements is discussed in terms of ionization potentials and free energies of hydration. The "stability" of the +3 oxidation state of the rare earths is not to be regarded as characteristic of electrons in general. Trends in the oxidation potentials of the 2—3 and 3—4 couples of the rare earths are interpreted in terms of the binding energy of the f electrons. Similar correlations are made for the actinide elements; hydrolysis enters as an additional complication in the case of the 4—5 and 4—6 couples. The electron configuration of thorium in the +2 oxidation state is probably $6d^2$. On the basis of the present evidence it is not possible to decide between an f and a d configuration for the +3 state. The oxidation potentials and electron configurations of protoactinium are briefly considered. (auth)

4262 The Position of the Cis- and Trans-uranic Elements in the Periodic System: Uranides or Actinides? M. Haissinsky. J. Chem. Soc. (London) 1949, Suppl. No. 2, 241-3.

Reasons are advanced against the classification of the cis-uranic elements (Ac,Th,Pa) in a new rare-earth series, the actinides, from a consideration of their chemical properties. (auth)

4263 Report on the Progress in Analytical Chemistry. Thorium. A. Eichler. Z. Anal. Chem. 129, 396-401(1949) (in German).

The following methods of thorium determination are described. (1) Titration of $Th(IO_3)_4$. The latter is obtained by precipitation with potassium iodate; the precipitate is dissolved in acid, KI is added, and the liberated iodine is titrated with sodium thiosulfate. The method is applicable in the presence of Y and the rare earths. It has been developed by Moeller et al (Analyt. Chem. 20, 1055(1948)) from a procedure given by Chernikhov et al (Zavodskaya Lab. 9, 276 (1940)). (2) The radiometric method of Moeller et al (Analyt. Chem. 20, 1201(1948)). Thorium is precipitated with sodium pyrophosphate containing radioactive P^{32}; and the activity of the filtrate, (measured with a G-M counter), is compared with that of a standard pyrophosphate solution. (3) Precipitation of thorium molybdate followed by titration of molybdic acid (Banks et al, Analyt. Chem. 19, 222(1947)). The precipitation is done with ammonium paramolybdate in the presence of acetic acid; through reduction with Zn amalgam a solution is obtained which, after the addition of iron alum and phospheric acid, is titrated with Ce(IV) sulfate using ferroin as indicator. A faster procedure is a direct titration of a thorium solution with ammonium paramolydate, using a calomel electrode and a molybdenum wire as an electrometric indicator. (4) An acidimetric method of thorium determination (by precipitation with NaOH) has been given by Tanteri (Ann. Chim. Applicata 33, 204(1943), see Chem. Abst. 40, 7058(1946)). (5) A simultaneous determination of thorium and Chromium was described by Ewing et al (Analyt. Chem. 20, 233(1948)). The solution is heated with perchloric acid in HCl solution, whereby chromium is distilled away as chromyl chloride; chromium is then determined by titration with Ce(IV) sulfate (Ferroin as indicator), and thorium is precipitated and weighed as oxalate.

4264 The Separation of Protoactinium. A. G. Maddock and G. L. Miles. J. Chem. Soc. (London) 1949, Suppl. No. 2, 253-6.

The method of separation of protoactinium based on its adsorption on MnO_2 precipitates followed by solvent extraction of its "cupferron" complex is described. (auth)

4265 A Tracer Study of the Chemistry of Protoactinium. A. G. Maddock and G. L. Miles. J. Chem. Soc. (London) 1949, Suppl. No. 2, 248-53.

The paper describes the results of a tracer investigation made in connection with the development of a method for the separation of natural protoactinium. The results emphasize the difficulty of interpreting the evidence of precipitation on carriers in the case of an element whose compounds are so prone to hydrolysis. The conditions for the stability of tracer concentrations of β-active Pa^{233} and α-active Pa^{231} in aqueous solutions have been investigated. The chemistry of aqueous solutions of protoactinium compounds more closely resembles that of zirconium compounds than tantalum. Similarities with the adjacent elements thorium and uranium are not marked. (auth)

CHEMISTRY

4266 Absorption Spectra of Tetravalent Uranium Salts; Proposed Classification Based on the Vibration Frequencies. Marie Freymann, René Freymann, Raymond Rohmer, and Pierre Hamon. Compt. rend. 230, 1524-6(1950) Apr. 24 (in French).

Research on the uranyl salts has led to a classification scheme for their fluorescence and adsorption bands; this classification involves the vibration frequencies of UO_2^{+2} (Duncan and Dieke, Spectroscopic Properties of Uranium Compounds, New York, McGraw-Hill, 1949, 290p. The authors have studied the spectra of Cl_4U and of Br_4U and propose a classification of their adsorption bands in the visible region, involving the vibration frequencies of these molecules.

4267 The Activity Coefficient of Uranyl Nitrate in the Presence of Sodium Nitrate. E. Glueckauf, H. A. C. McKay, and A. R. Mathieson. J. Chem. Soc. (London) 1949, Suppl. No. 2, 299-302.

The activity coefficient γ_1 of uranyl nitrate in presence of sodium nitrate has been measured by a solvent-extraction method, using a technique of circulating an organic uranyl nitrate solution through a series of aqueous solutions. At constant ionic strength it has been found that log γ_1 varies linearly with the sodium nitrate molality. Thermodynamic arguments show, however, that log γ_2, where γ_2 is the activity coefficient of the sodium nitrate, cannot be a simple linear function of the uranyl nitrate molarity. (auth)

4268 Application of the Lead Reductor to Determination of Uranium. William D. Cooke, Fred Hazel, and Wallace M. McNabb. Anal. Chem. 22, 654-5(1950) May.

Uranium can be reduced quantitatively to the quadrivalent state with lead. High concentrations of sulfuric acid can be tolerated, provided a sufficient concentration of hydrochloric acid is present. Reduction is rapid and amalgamation of the metal is unnecessary. The uranium(IV) is determined indirectly by the addition of an excess of iron(III) and subsequent titration of iron(II) with standard dichromate solution. (auth)

4269 The Carbides of Uranium and Thorium. H. A. Wilhelm, P. Chiotti, A. I. Snow, and A. H. Daane. J. Chem. Soc. (London) 1949, Suppl. No. 2, 318-21.

Uranium carbides corresponding to UC (C,4.8%) are shown to exist. There is no evidence of solubility of uranium in the monocarbide. The monocarbide is stable at room temperature, and the dicarbide is stable at high temperatures but partly decomposes into monocarbide and carbon at lower temperatures. There is evidence of solubility of carbon in the dicarbide at high temperature. At high temperatures and at compositions in the neighborhood of 7% of carbon there is a possibility either that a compound, U_2C_3, exists, which dissolves UC and UC_2, or that the last two carbides from a continuous solid solution. Although the Widmanstätten type microstructure indicates that "U_2C_3" consists of one phase at high temperature, all attempts to retain this one-phase structure by quenching have been unsuccessful. Metallographic and x-ray investigations indicate that no compounds other than those listed above occur between uranium and carbon. Thorium carbides, ThC and ThC_2, are shown to exist. From a study of thorium-carbon alloys containing up to 14% of carbon no definite evidence is found either by microscopic observation, x-ray analysis, or melting-point data for the existence of other compounds. The monocarbide has a face-centered cubic sodium chloride type structure with a lattice constant $a_O = 5.325$ A., and the dicarbide has a pseudo-tetragonal lattice. The melting points of ThC and ThC_2 are found to be 2625° ± 25° and 2655° ± 25°, respectively. The dicarbide forms a eutectic with graphite melting at 2500° ± 35°.

4270 The Formation of Complex Ions in Uranyl Sulfate Solution. T. V. Arden. J. Chem. Soc. London (1949), Suppl. No. 2, 299.

Studies on the reactions of uranyl sulfate with calcium hydroxide and other alkalis give additional information on the nature of the complex ions present in uranyl sulfate solutions. Results obtained from potentiometric and conductimetric titrations resemble those obtained by Sutton.

4271 The Hydrolysis of the Uranyl Ion. Part I. J. Sutton. J. Chem. Soc. London (1949), Suppl. No. 2, 275-86.

Cryoscopic measurements prove conclusively that the hydrolysis of uranyl salts leads to the formation of the ions $U_2O_5^{+2}$ and $U_3O_8^{+2}$, and not $UO_2(OH)^+$ and $UO_2(OH)_2$. Measurements of pH of solutions of UO_3 in solutions of uranyl salts, pH titrations of uranyl perchlorate and sodium hydroxide, and the conductivity and absorption spectra of these solutions, point to the formation of further ions $U_3O_8(OH)^+$, $U_3O_8(OH)_2$, and $U_3O_8(OH)_3^-$. More highly charged anions may be formed, but the evidence is still inconclusive. The equilibrium constants for the formation of some of these ions have been determined. (auth)

4272 Ionic Association in Aqueous Solutions of Uranyl Sulphate and Uranyl Nitrate. R. H. Betts and Rita K. Michels. J. Chem. Soc. London (1949), Suppl. No. 2, 286-94.

Spectrophotometric methods have been used to study ionic association in aqueous solutions of uranyl nitrate and uranyl sulfate. The stoichiometric association constants for the equilibria $UO_2^{+2} + HSO_4^- \rightleftharpoons UO_2SO_4 + H^+$ and $UO_2^{+2} + NO_3^- \rightleftharpoons UO_2NO_3^+$ were found to be 5·0 ± 0·34 and 0·21 ± 0·01, respectively. These values were obtained for solutions 2M in hydrogen ion. Results for concentrations of nitrate greater than 3M could not be interpreted with assurance. In this region, either small amounts of $UO_2(NO_3)_2$ are formed, or, more probably, the value of the association constant changes slightly with the ionic environment. (auth)

4273 A New Method for the Detection and Determination of Uranium. T. V. Arden, F. H. Burstall, and R. P. Linstead. J. Chem. Soc. (London) 1949, Suppl. No. 2, 311-3.

A chromatographic method employing organic solvents in conjunction with strips or sheets of absorbent paper is described for the separation of uranium from other metals in solution. Uranium as uranyl nitrate is dissolved and moves with the solvent front as diffusion of the solvent in the absorbent paper proceeds. Most other metals remain stationary or move only slowly in comparison with uranium. Detection is accomplished with potassium ferrocyanide while quantitative determination is achieved by removal of the portion of paper containing the uranium, followed by measurement with the polarograph, colorimeter, or fluorimeter. (auth)

CHEMISTRY

4274 Note on the Solubility of Thorium Nitrate Tetrahydrate and Uranyl Nitrate Hexahydrate in Organic Solvents. L. Yaffe. Can. J. Research 28, 171(1950) Apr. (Brief note).

This is a note concerning the paper by Templeton (Can. J. Research 28, 156(1950)Apr.) concerning the fact that the previous investigators were both attempting to establish general relationships between the solubilities of the nitrates of heavier metals rather than attempting to establish definite solubilities; the author comments that the establishment of absolute solubility necessitate the use of a very rigorous purification procedure which was not attempted in any way.

4275 On the Molecular Structure of Uranium Hexafluoride. Fausto G. Fumi and Gilbert W. Castellan. J. Chem. Phys. 18, 762(1950)May (Letter to the Editor).

Recently Bauer (J. Chem. Phys. 18, 27(1950)) studied the molecular structure of uranium hexafluoride by means of electron diffraction. The authors make an attempt to interpret his results theoretically and arrive at the conclusion that either of two models of the structure of uranium hexafluoride are probable. One of the models is obtained by distortion of a trigonal antiprism of symmetry C_{3v}, the other by distortion of an octahedron of symmetry C_{2v}.

4276 On the Solubility of Thorium Nitrate Tetrahydrate and Uranyl Nitrate Hexahydrate in Organic Solvents. Charles C. Templeton and Norris F. Hall. Can. J. Research 28, 156-60(1950) Apr.

The values reported by Yaffe for the solubilities of thorium nitrate tetrahydrate and uranyl nitrate hexahydrate in various organic solvents are compared with those previously reported by Templeton and Hall, the former having been much lower than the latter. Some of the accessory experiments of the latter authors are presented in support of the position that their values more closely correspond to equilibrium than the values of Yaffe. The method is described. The results are presented in a graph of the thorium nitrate tetrahydrate solubility plotted against the number of days of agitation for ethyl butyrate, isoamyl alcohol, and propiophenone used as solvents, and in a table of uranyl nitrate hexahydrate solubility in isoamyl alcohol, methyl-n-hexyl ketone, and ethyl butyrate, determined after agitation of the solutions for 5 days at 25°C.

4277 The Oxides of Uranium. K. B. Alberman and J. S. Anderson. J. Chem. Soc. London (1949), Suppl. No. 2, 303-11.

Phase equilibria in the uranium-oxygen system between the composition limits UO_2 and $UO_{2.3}$ have been investigated in detail with regard both to the structure of the phases formed and to the kinetics of their formation from UO_2 and oxygen. The dioxide, which possesses a fluorite structure, will take up oxygen at temperatures below 230° to a composition $UO_{2.2}$ without change of structure or appreciable change of cell dimension. Oxides in this composition range disproportionate, when annealed at high temperature, into 2 well-defined cubic phases, viz., UO_2 and a phase of composition close to $UO_{2.2}$ ("β-UO_2 phase"). Oxides in the composition range $UO_{2.2}$—$UO_{2.3}$ prepared below 230° have tetragonal structure with axial ratio c/a changing progressively with composition; these oxides disproportionate on heating into the β-cubic phase and a U_3O_8-like phase. Kinetic studies

CHEMISTRY

of the oxidation process suggest that oxidation proceeds by way of a diffusion-controlled reaction in a solid phase of variable composition. These studies suggest a general similarity between the oxides of uranium and those of molybdenum and tungsten. (auth)

4278 Preparation of Uranium Trioxide. Irving Sheft, Sherman Fried, and Norman Davidson. J. Am. Chem. Soc. 72, 2172-3(1950) May.

The method for the preparation of UO_3 described here is considered to be superior to those commonly used because the purity of the product is dependent only on the purity of the original U_3O_8, which should be high for good results, and the product is obtained in 100% yield. The oxygen is dried and purified during the liquefaction so that this presents no problem, while U_3O_8 is generally obtained sufficiently pure. Within wide limits the temperature at which the reaction is run is not critical. The upper temperature limit, however, is important. Experiments run at 750° yielded oxides intermediate between U_3O_8 and UO_3. Even at 750°, however, UO_3 can be prepared by going to pressures over 400 psi. Preparations made at temperatures as low as 550° also yielded UO_3, but required somewhat longer time for complete reaction. (auth)

4279 Reactions of Some Thorium and Uranium Compounds in Liquid Ammonia. George W. Watt, W. A. Jenkins, Jr., and Jane M. McCuiston. J. Am. Chem. Soc. 72, 2260-2(1950) May.

Thorium (IV) nitrate 4-hydrate reacts with liquid ammonia at −33.5° to form ammonium nitrate and, probably, hydrated thorium (IV) oxide. The ammonolysis of thorium (IV) sulfate by liquid ammonia at −33.5° yields ammonium sulfate and other products believed to be basic sulfates of thorium. The solubilities of thorium (IV) iodate and thorium (IV) oxalate 2-hydrate in liquid ammonia at 25° have been measured. These salts are unreactive toward liquid ammonia at 25° and at −33.5°. Uranium peroxide 2-hydrate does not react with liquid ammonia or with liquid ammonia solutions of ammonia bromide at −33.5°. The peroxide reacts with potassium amide to form potassium peruranate, but is only slowly reduced by solutions of potassium. Uranyl nitrate 6- and 2-hydrates react with liquid ammonia at −33.5° to form ammonium diuranate, e. g., $2UO_2(NO_3)_2.2H_2O + 6NH_3 = (NH_4)_2U_2O_7 + 4NH_4NO_3 + H_2O$. Uranium (III and IV) chlorides and bromides are ammonolyzed by liquid ammonia at −33.5° and the resulting ammonolysis products are not reduced to elemental uranium by solutions of potassium. The preparation of uranyl nitrate 2-hydrate 3-ammonate is described. (auth)

4280 Stability of Complexes of Uranyl Nitrate with Ketones and Ethers. A. R. Mathieson. J. Chem. Soc. (London) 1949, Suppl. No 2, 294-8.

New complexes of uranyl nitrate with ketones have been prepared by dissolving $UO_2(NO_3)_2.6H_2O$ in the ketones, and subsequent crystallization. Those formed by acetone and methyl ethyl ketone were shown by analysis to have the formula $UO_2(NO_3)_2.3H_2O.X$ (X = ketone). The vapor-pressure curves of evaporating solutions of the complexes in their own ketone as solvent, determined at different temperatures, enabled the estimation of the energies of rupture of the ketone-uranyl nitrate bonds. The formation by diethyl ether of a complex $UO_2(NO_3)_2.3H_2O.(C_2H_5)_2O$ was confirmed, and related compounds appear to be formed by

CHEMISTRY

$Co(NO_3)_2.6H_2O$ with some ketones. The absorption spectra of organic solutions of the complexes were compared with that of $UO_2(NO_3)_2.6H_2O$ in water. The bearing of these results on the solubility of uranyl nitrate in the solvents under consideration is discussed. (auth)

ENGINEERING

4281 The Application of Turbulent Flow Theory to Transfer Processes in Tubes Containing Turbulence Promoters and Packings. H. R. C. Pratt. Atomic Energy Research Establishment Report AERE-C/R-450, Mar. 1950. 25p.

The application of turbulent flow theory to transfer processes is reviewed briefly, and it is shown that a condition can be defined where the thickness of the laminar film is a minimum. This condition, which may be referred to as that of infinite induced turbulence, leads to an expression for the maximum possible heat transfer coefficient. A similar equation may be derived for the mass transfer coefficient. It is also shown that the transfer coefficient should break away from the expression at low values of the Reynolds number and ultimately become identical with that for a smooth tube. A plot is given of the equation, and data from sources for heat and mass transfer in tubes containing turbulence promoters and packings are included for comparison. Based on this, it is shown that the transfer coefficient for any filling may be predicted approximately from the measured pressure drop using derived equations. 45 references.

4282 A Study of the Thermal Conductivity of Santocel. J. R. Parks. MLM-453, nd. 9p.

A twin calorimeter with a sample side and a reference side for comparing the thermal conductivities of two materials has been designed and constructed. Styrofoam, a cellular polystyrene, was used as the gradient medium for two steady-state bridge type calorimeters with cylindrical geometry. A comparison of the thermal conductivity of Styrofoam with that of air closely approximated that of the manufacturer and indicated that the two calorimeters using the Styrofoam have heat flow patterns that approximate spherical flow much more closely than radial flow. The thermal conductivity of samples of Santocel A (produced by replacing water in silica gel with alcohol and subsequent removal by heating in an autoclave and bleeding under pressure), Santocel AO, and a special grade of Santocel was compared with that of air, also. The results are inconclusive, however the material appears to be a promising material for calorimeter construction.

4283 Vacuum Pumps — Part 2. Diffusion Pumps. E. Blasco and L. Miranda. Ion (Madrid) 10, 195-202, 234(1950) Apr. (in Spanish).

The characteristics of various types of diffusion pumps are discussed. 14 references.

MINERALOGY, METALLURGY AND CERAMICS

4284 Preparation and Properties of Refractory Cerium Sulfides. E. D. Eastman, Leo Brewer, LeRoy A. Bromley, Paul W. Gilles, and Norman L. Lofgren. J. Am. Chem. Soc. 72, 2248-50(1950) May.

The methods of preparation, apparatus used, and the physical, chemical, and thermodynamic properties of the cerium sulfides have been discussed. The stability and low reactivity of these sulfides should make their use as refractories very valuable for many applications, especially where it is desirable to prevent oxygen contamination and where one is dealing with very electropositive metals. (auth)

4285 Investigation of Formation Conditions of Certain Minerals with the Aid of the Isotopic Method. E. I. Dontsova. Doklady Akad. Nauk S.S.S.R. 71, 905-6 (1950)(in Russian).

Oxygen in air and in carbonate rocks of sedimentary origin has a O^{18} content that is about 7 γ higher than that in oxygen of river water. This observation can be used for the determination of the geochemical conditions of formation of certain minerals of the oxide class. Various hydrated iron oxides (limonites and hydrogoethites) and magnetites were used to test the method. The first named are known to be deposited under water or within loose formations in groundwater zone; the magnetites examined were formed within limestones by contact-metamorphic agents. The analysis of the first group (after elimination of water of crystallization) showed that the O^{18} content of their oxygen approached that of O in water, while a similar investigation of magnetites revealed a 5 γ excess. This latter result points to the CO_2 of the limestone as the probable source, (under definite conditions of pressure), of the mineral's oxygen. The method used involved determinations of specific gravities of synthetic water; its accuracy was ± 0.4 γ.

4286 Recent Analyses for Age by Lead Ratios. O. B. Muench. Bull. Geol. Soc. Am. 61, 129-32(1950).

The Pb, U, and Th in the following radioactive minerals were determined and the Pb-U ratio was calculated: pitchblende from Wood's Mine, Central City, Colorado, 0.0147; pitchblende from Gilpin County, Colorado, 0.0167; monazite from the Huron claim, Manitoba, 0.257; monazite from Bull Creek, about 15 miles from Las Vegas, New Mexico, 0.106; euxenite from Trout Creek Pass, Colorado, 0.059. A complete analysis of the euxenite is given. The age of the pitchblende from Central City was calculated from the log formula of Holmes (Natl. Research Council (U.S.), Bull. 80, 124-459) to be 111,000,000 years.

4287 Determination of Activation Energies for Secondary Creep. Fifth Technical Report. T. H. Hazlett, E. R. Parker, and M. W. Nathans. COO-4, May 1950. 40p.

The purpose of the present report is to present the results of a preliminary series of creep tests on commercially pure nickel. The following conclusions may be drawn from the results obtained: 1. The creep rates and temperature coefficients for secondary creep under constant stress conditions are essentially independent of prior thermal and strain history. This conclusion is valid when the structure of the material is stable during the test and the testing temperature range is above a presumed limiting value. 2. A method of accelerating creep testing within the higher temperature range is indicated. Since the state of metallurgically stable material becomes independent of prior history during secondary creep, the initial part of the test may be carried out at high temperatures and correspondingly high creep rates. Subsequently the temperature may be reduced and the secondary creep rates determined for each tempera-

ture. The temperature coefficient Q thus obtained permits interpolation of creep rates for intermediate temperatures. Therefore, one relatively rapid test permits evaluation of creep rates over a temperature range for a given stress level. 12 references.

4288 Change of State of Nickel During Secondary Creep at High Temperatures. Seventh Technical Report. K. B. Lloyd, T. H. Hazlett, and E. R. Parker. COO-5, May 1950, 12p.

The object of the present investigation with commercially pure nickel was to determine whether the room temperature tensile properties and the back reflection x-ray patterns remained unchanged during secondary creep. The following conclusions were drawn from the results: 1. There is a continuous change of internal state in metals during primary creep. 2. The material approaches a steady state condition during secondary creep. 3. A stable crystallite size is associated with the secondary stage of creep. 4. Room temperature mechanical properties are essentially unchanged by strains associated with secondary creep. This is true for nickel at 700°C but may not be true for creep tests carried out at lower temperatures. 10 references.

4289 Role of Sub-Structure Developed During Plastic Flow on the Mechanical Properties of Metals. Fourth Technical Report. E. R. Parker, T. H. Hazlett, and M. W. Nathans. COO-10, May 1950. 13p.

A brief review of the available information on the recovery and recrystallization of cold worked metals is given. The significance of this information in relation to creep at elevated temperatures and in explaining the mechanisms of strain hardening is discussed. 15 references.

4290 Some Considerations Concerning the Strain Hardened State of Metals. Sixth Technical Report. M. W. Nathans, E. R. Parker, and T. H. Hazlett. COO-11, May 1950. 21p.

The back stress concept and the crystallite concept of metal deformation and creep are discussed. It is shown that the temperature coefficient for plastic deformation may contain a term that depends upon the strain-hardened state of the material. Although this term may be appreciable, it is difficult to make a true estimate of its value. With respect to the effect of changes of stress and temperature certain predictions are made which are in disagreement with those of the nucleation theory of Leschen et al (Nucleation of Slip Bands, A.I.M.E. Tech. Pub. 2276. Met. Tech., Sept. 1948). 16 references.

4291 The Spectrochemical Analysis of Bismuth Matrices Employing the Porous Electrode Technique. J. C. Delaney and L. E. Owen. NEPA-1424, May 12, 1950. 19p.

A spectrochemical procedure for the analysis of Be, Co, Cr, Fe, Mn, Mo, Nb, Ni, Ta, Ti, V, and W in Bi matrixes is described. The technique developed calls for the excitation in a porous cup electrode of solutions representing the dissolved sample and containing an added internal standard element. Analytical curves were obtained by means of standard solutions prepared and excited in a manner analogous to that of the samples. Intensity ratios obtained from duplicate

MINERALOGY, METALLURGY AND CERAMICS

excitations of samples agreed within 20% for lines having transmission values from 5 to 90%. In most cases, the agreement was nearer 5% or even closer. The experimental work justifying the procedure is detailed.

4292 Progress Report for the Period July to December 1949. Paul Fugassi and Chester Markle. NYO-532, Feb. 15, 1950. 3p.

Potassium formate is being used as a fused electrolyte. In the vicinity of 200°C it appears to be sufficiently stable for use in the lead-gallium system. A vacuum oven of all glass construction has been made. Requirements have been set up for the design of electrodes for the electro-chemical investigation of the lead-gallium system. The preparation of one kind of electrode for this purpose is described.

4293 Alloys for High-Temperature Service. Quarterly Progress Report. Howard C. Cross. Battelle Memorial Institute, Mar. 16, 1949. 35p. (AEC File No. NP-1416.)

This report covers the work done during December 1948 through February 1949. Tensile-fatigue testing of S-590 alloy at 1200°F, using dynamic loading of ±15,000 psi has been completed. All of the axial-loading fatigue tests of low-carbon N-155 alloy involving tension only have been completed at 1200, 1350, and 1500°F, and curves of the range of fatigue stress versus mean stress have been plotted. Fifteen heats of chromium-base alloys were prepared in the vacuum apparatus for property evaluation. Specimens from 19 heats of chromium-base alloys were tested in creep rupture at 1600°F and 40,000 psi. Many of the creep-rupture bars from chromium-base alloy heats have broken during loading. Consequently, a program has been set up to evaluate the effects of melting and casting practice, composition, and heat treatment on the shock resistance of chromium-base alloys at room temperature, and no additional heats will be prepared for testing until some knowledge is gained as to the factors influencing the shock resistance of this material. In the precision casting of the 58Cr-15Fe-25Mo-2Ti type alloy in the form of turbine blades, promising results were obtained using the frozen-mercury-pattern method. Work was continued on the accurate determination of the alpha-beta transformation temperature range in the cobalt-chromium-nitrogen and cobalt-chromium-iron systems, and on the delineation of the solubility limit of gamma in beta of the cobalt-chromium-nitrogen alloys. Several creep-rupture test coupons of cobalt-chromium alloys were prepared. Preliminary creep-rupture tests to determine the range of stresses to be used in testing high-purity cobalt-chromium binary alloys were completed, and tests are now in progress on the 80Co-20Cr and 68Co-32Cr alloys.

4294 Cerium. L. Sanderson. Can. Mining J. 71, 71-2 (1950) May.

The physical properties of cerium are given, and the different sources from which the element is obtained are described. It is found in the minerals monazite, cerite, allanite, and gadolinite and is also recovered as a by-product in the manufacture of thorium nitrate and in other processes. The production of cerium metal and alloys is discussed along with the uses of cerium compounds. Because of the high reactivity of the molten cerium metal with oxygen, hy-

drogen, and nitrogen, the production of the metal is undertaken in a vacuum.

4295 High-Temperature Heat Contents of Some Zirconium-containing Substances. J. P. Coughlin and E. G. King. J. Am. Chem. Soc. 72, 2262-5(1950) May.

Heat contents above 298.16°K were measured for zirconium, zirconium oxide, zirconium nitride, zirconium silicate, and zirconium tetrachloride to the respective temperatures, 1370, 1841, 1672, 1823, and 567°K. The heat of transition of zirconium metal is 920 cal/mole, respectively. A table of smooth values of heat-content and entropy increments above 298.16°K was constructed, and representative heat-content and heat-capacity equations were derived. (auth)

4296 The Oxidation of Beryllium at High Temperatures. Daniel Cubicciotti. J. Am. Chem. Soc. 72, 2084-6 (1950) May.

The rate of the reaction between beryllium metal and oxygen gas has been studied from 840 to 970°C. The oxidation was found to proceed according to the parabolic law $w^2 = kt + C$, where w is the amount of reaction at time t, k is the rate constant, and C is a constant. The values of k were very small compared to other metals and were constant over a wide range of oxygen pressure, the temperature being held constant. From the slope of log k vs $1/T$, where T is the absolute temperature, the energy of activation for the reaction was found to be 62 kcal/mole.

4297 Facts About Monazite-bearing Areas. Wenceslau Rosa. Observador, 50-6(1950)(in Portuguese).

In comparison with uranium ores, there is practically no demand for thorium-containing minerals on world markets. However, there are indications of an increasing interest in thorium in the United States and other countries. Some details on the present state of the commercial exploitation of thorium-bearing monazites (and ilmenites) in Brazil are given, together with some information on the geological characteristics of the deposits.

4298 Geology of the Fissionable Materials. George W. Bain. Econ. Geol. 45, 273-323(1950) June-July.

A thorough summary is made of the types of uranium and thorium occurrences and their regional distribution throughout the world. The relative abundance and difficulty of recovery of the two elements in their various forms are discussed. The Witwatersrand gold mines of South Africa are indicated as the most economical source of industrial uranium for the immediate future.

4299 Research Studies in Mineral Engineering Using Radionuclides. A. M. Gaudin and P. L. de Bruyn. Sci. Monthly 70, 365-75(1950) June.

The application of radionuclides to mineral dressing is described along with a discussion of the detailed mechanism of the flotation process of mineral separation. A brief discussion of some typical problems on which radioisotopes are used is given. A table is included listing several radioisotopes which may be used in mineral engineering. The decay scheme, half-life, energy of radiation (Mev), and detection method are also given.

4300 Study by the Photographic Method of Active Deposits of Various Radioactive Substances. Arlette Hee, Michel Jarovoy, and Joseph Kleiber. Compt. rend. 230, 1520-2(1950) Apr. 24 (in French).

Several substances rich in uranium and thorium (Colorado carnotite, Tonkin autunite, and Ceylon thorianite) were electrically deposited on metal discs which were then placed in contact with Ilford plates for periods ranging from about 4 hr to about 4 days. The authors then made a statistical study of lengths of the α tracks found in the plates after various exposure times. On the basis of this study they have identified the radioactive elements contained in these minerals.

MINERALOGY, METALLURGY AND CERAMICS

PHYSICS

4301 The Organization and Scope of Nuclear Physics Research in Belgium. T. Coor. Office of Naval Research (London Branch) Technical Report OANAR-20-50, Feb. 1, 1950. 13p.

Belgium has launched an extensive program with government financing for the building up of nuclear research. This program is being administered by the Fonds National de la Recherche Scientifique, and has the two-fold aim of training students and developing research facilities. There are six centers of nuclear research, at the Universities of Brussels, Liege, Louvain, and Ghent, at the Ecole Royale Militaire, and at the Faculte Polytechnique. In effect since July 1947 and operating at the rate of Fr. 5,000,000 ($100,000) per year, the plan has produced significant results. (auth)

4302 Quarterly Progress Report, January 1 - March 31, 1950. BNL-51, nd. 85p.

Progress and new information in the accelerator project, biology department, chemistry department, instrumentation and health physics department, medical department, physics department, and reactor science and engineering department are reported under the following topics: the Cosmotron (3 Bev proton synchrotron) and its major components; biological effects of radiation on animals and plants; tracer studies of biochemical problems with animals, plants, and accumulator organisms; magnetic susceptibility of a solid solution of $MnCl_2$ and $SrCl_2$; ultraviolet absorption spectra of some rare earth salts in solutions fluid at the temperatures of liquid nitrogen; solubility of argon in propane and its reaction with BCl_3 dissolved in propane at 77°K; protoactinium chemistry; nuclear recoil following neutrino emission from Be^7; thallous-thallic exchange reaction; exchange reaction between ferrous and ferric ions in perchloric acid solutions; isotope effect on bond rupture by electron impact on hydrogen, deuterium, and tritium; oxygen and nitrogen isotope effects in the decomposition of ammonium nitrate (decomposition of $N^{15}H_4NO_3$, reaction initiated by H_2O^{18}, decomposition and isotopic composition of NH_4NO_3, vibrational spectrum and thermodynamic properties of the isotopic N_2O molecules); synthesis of L-ascorbic acid uniformly labeled with C^{14}; decay scheme of Ni^{57}; stable high voltage supply; precision timer; particle range sorter; G-M tubes for liquid flow scintillation counters for civil defense monitoring; atmospheric potential gradient recorder; lethal dosage of γ radiation from Co^{60} for an injection-free colony of mice; isomerism in Ti^{51} and nuclear shell theory; "memory" in angular correlation of γ rays from decay of Pb^{204}; hard γ rays; β-ray spectrum of K^{40}; neutron-deuteron collisions; photodisintegration of rhodium; fast neutron cross sections and nuclear shells; time-of-flight velocity selector to operate on neutrons from the pile with energies between

PHYSICS

1 ev and 100,000 ev; altitude and latitude dependence of bursts in a lead shielded ion chamber; energetic stars at different latitudes; high pressure cloud chamber; high speed expansion value for cloud chamber control; construction of a large permanent magnet for cloud chamber work; coherent n-p scattering by liquid mirror reflection; oriented overgrowth of alkali halides on metal crystals; quantum field theory; scattering induced curvature of fast charged particles; dosage from homogeneously distributed emitter; systematics of γ decay; radioactive waste disposal.

4303 Cosmogonical Problems and Stellar Energy. D. ter Haar. Revs. Modern Phys. 22, 119-52(1950) Apr.

After a review of recent developments in cosmogony, the author discusses the origin of the planetary system, the origin of the chemical elements, and the origin of cosmic rays. Then follows a section devoted to problems arising in connection with the production of energy in stars, viewed from the standpoint of nuclear physics. More than 100 literature references.

4304 The Genesis of the Chemical Elements. D. ter Haar. Nederland. Tijdschr. Natuurk. 15, 85-95(1949) Apr. (in Dutch).

A critical survey is given of work on the subject during the last decade. The main aspects discussed, starting with Klein, Beskow, and Treffenberg's original theory are: excited condition of the nuclei; electrostatic effects (important at the high densities considered); effects of gravitation. Secondary problems are: the transition from extreme temperatures and densities to normal ones without upsetting the state of equilibrium; transition from possibly radioactive nuclei to the stable ones; the region where these hypothetical processes occur; relation between these processes and cosmogony (star formation proper). The most recent cosmogonical theory, that of Gamow and Alpher, explaining the present concentrations of elements on a synthetic process of an almost spontaneous character at the beginning of time according to the sequence of "creation": neutrons-protons-deuterons, leads to a good agreement between calculated and existing concentrations of elements; yet the other theories, i.e., those more concerned with the role of the stars, agree among themselves on the fact that the present concentration can be fully explained by later eruptions of O, B, and A stars. The conclusion drawn by the author is that the present state is more or less stationary.

4305 Regularities of Isotopic Abundances. A. E. Kempton. Nature 165, 801-2(1950) May 20.

The author reviews the subject of the abundances of the various isotopes, pointing out various regularities. To explain these regularities, a twofold hypothesis is assumed, i.e., the cosmological origin of the elements, and the regular variation of some nuclear parameter with the atomic number. As regards the cosmological hypothesis, the experimental material can be interpreted in terms of the formation of the elements by neutron capture or the equilibrium theory. In either case the explanation is simplest if the nuclear parameter involved is the neutron capture cross section.

4306 Theory of the Origin and Relative Abundance Distribution of the Elements. Ralph A. Alpher and Robert C. Herman. Revs. Modern Phys. 22, 153-212(1950) Apr.

PHYSICS

The observed abundances of the elements are described in detail. Two main groups of theories are discussed which account for the origin and relative abundances of the elements: equilibrium theories and nonequilibrium theories. Equilibrium theories depend primarily on the correlation between the abundances and the binding energies of nuclei, and equilibrium concentrations of various kinds of nuclear species are treated by well-known thermodynamical and statistical methods. Early work and basic theories are reviewed, as well as the effect of excited nuclear states, degeneracy and electrostatic effects, and gravitational effects and stellar models. Nonequilibrium theories involve in the main neutron capture reactions. The author discusses the assumed prestellar state of the expanding universe, neutron capture cross sections, the formation of light elements, and the effect of nuclear stability. Another variant of nonequilibrium theory briefly dealt with is the polyfission theory. 180 literature references.

4307 Cosmic Radiation and its Biological Effects. Victor F. Hess and Jakob Eugster. N. Y., Fordham Univ. Press, 1949, 173 p.

The first half of this book is devoted to a review of cosmic radiation, its discovery, distribution, time variations, and interactions with matter. Meson production and the composition and origin of cosmic radiation are treated in the light of the literature of 1948. The second half gives a survey of the more important studies of biological effects of cosmic radiation and describes the author's own experiments with bacteria, plants, rabbits, and mice. In one series of experiments, no rabbits living below a lead plate produced live young, presumably because of shower production in the lead, while controls without lead reproduced normally. 250 references.

4308 Magnetic Deflection of Cosmic-Ray Mesons Using Nuclear Plates. Ian Barbour. Phys. Rev. 78, 518-25(1950) June 1.

This is an amplified version of a letter to the Editor which appeared in the Phys. Rev. 76, 320(1949) July 15. An abstract from the letter appeared in Nuclear Science Abstracts as Abstract 3-1233.

4309 Note on the Fluctuation Problem of Cascades. L. Jánossy. Proc. Phys. Soc. (London) 63A, 241-9 (1950) Mar. 1.

Diffusion equations governing the fluctuations of nucleon cascades and also of electron-photon cascades are given. The electron cascade is treated at first in the usual approximation, but it is shown that the approximations are not essential for the treatment. The diffusion equations appear in the form of integro-differential equations which can be solved directly using numerical integration. It is hoped to present numerical solutions in a later publication. (auth)

4310 Nuclear Transmutations Produced by Cosmic-Ray Particles of Great Energy. Part IV. The Distribution in Energy, and the Secondary Interactions of the Particles Emitted from Stars. U. Camerini, P. H. Fowler, W. O. Lock, and H. Muirhead. Phil. Mag. 41, 413-28(1950) May.

The measurements of "multiple scattering" and "grain density" discussed in Parts II (Phil. Mag. 40, 1073(1949)) and III (Phil. Mag. 41, 169(1950)) of the present series of

papers, have now been extended to include a total of 1000 tracks of particles associated with "stars." The method of measurement and the criteria for the selection of tracks were similar to those described previously (III). The new material provides additional evidence in support of the view that most of the mesons ejected from nuclear explosions with kinetic energy less than 150 Mev are π-particles. The distribution in energy of the ejected mesons, protons, deuterons, and tritons has been determined, and it is shown that the "spectrum" for the mesons is in good agreement with that calculated by Sands (Phys. Rev. 77, 180(1950)). The mean free-path for nuclear interaction of the various types of particles in passing through the emulsion has been determined. The value obtained for mesons corresponds to a cross section for the interaction equal to the "geometrical" value. (auth)

4311 On the Production of Penetrating Showers in Nuclear Collisions. K. Sitte. Proc. Phys. Soc. (London) 63A, 295-6(1950) Mar. 1 (Letter to the editor).

Recently Heitler and Jánossy (Proc. Phys. Soc. (London) 62A, 374(1949)) have given a theory of meson production and applied it to the absorption of the particles that produce local penetrating showers. Their calculations are based on the assumption that the probability w of an energy ϵ by a nucleon of energy E in a collision with another nucleon follows a law of the form $w(\epsilon, E)d\epsilon = w(\epsilon/E)d\epsilon/E$. The author shows that various experimental results on penetrating showers support the assumption, especially the rather low vertical intensity $(1.6 \pm 0.3) \times 10^{-5} cm^{-2} sec^{-1} sterad^{-1}$ of the charged particles which produce, in lead, showers containing at least three particles capable of penetrating more than 200 g/cm² Pb.

4312 On the Transition Effect in the Positive Excess of Slow Mesons. G. B. Zhdanov and A. A. Khaĭdarov. Doklady Akad. Nauk S. S. S. R. 71, 33-5(1950)(in Russian).

By the method of delayed coincidences, a study was made of the "positive effect" δ of slow mesons of 2 μsec half-lifetime, in air and under dense materials. The values of $\delta = 2(n^+ - n^-)/(n^+ + n^-)$, (where n^+ and n^- are, respectively, the numbers of positive and negative mesons), were determined by using, successively, Al and C absorbers, in which the mesons stopped and decayed; the number of such mesons (per unit time) is, approximately, $n = n^+ + n^-$ in the case of an Al absorber ($Z < 10$), while it is $n = n^+$ in the case of a C absorber ($Z > 10$); certain corrections compensate for the inexactitude of these equations. The following values of δ were found: -0.27 ± 0.09 in air; $+0.15 \pm 0.06$ under 40 g/cm² C; and $+0.09 \pm 0.08$ under 140 g/cm² Pb. The peculiar transition effect of δ can be explained by assuming that some of the recorded mesons are generated by certain short-lived low-energy mesons of the π type; such an assumption does not contradict the existing data on the transition effect of π mesons of both signs (Harding, Nature 164, 285(1949)), and it can be concluded from the foregoing values of δ that the range of the "short-lived" mesons does not exceed ~40 g/cm² of matter and that at least 70% of them are negative.

4313 Some Decay Effects of Mesons in Penetrating Showers Observed in a High-Pressure Wilson Cloud Chamber. G. R. Evans and T. C. Griffith. Proc. Phys. Soc. (London) 63A, 296-7(1950) Mar. 1 (Letter to the editor).

A photograph is presented of a penetrating shower of six particles which was obtained with a counter-controlled Wilson cloud chamber containing nitrogen at a pressure of 60 atm. The shower, which originates in a lead plate placed above the cloud chamber, shows two interesting events. One of the particles can be identified as a slow π-meson decaying in flight into a μ-meson. Another particle has a track starting in the gas as if it came directly (or nearly so) from the star. This particle may be due to the scattering of a photon produced by a neutral meson originating from the star, but the authors believe this to be unlikely and suggest the possibility that a neutral meson, coming directly from the star, may be able to acquire a charge without an exchange of energy taking place.

4314 Some Observations on the Nuclear Disintegrations Caused by Cosmic Rays in Photographic Emulsions. Nora Page. Proc. Phys. Soc. (London) 63A, 250-8 (1950) Mar. 1.

An account is given of a study of 2150 stars in Ilford C2 plates and 312 stars in Kodak NT4 plates exposed under different conditions. Possible values for the cross section for star-producing collisions are discussed. It is concluded that this collision cross section is equal to the geometrical cross section of nuclei, and that the stars producing particles are noncatastrophically absorbed, leading to the observed absorption cross sections. It is shown that nuclear transparency could not account for the observed results. It is estimated that 17% of all stars and 40% of stars from which two or more lightly ionizing particles are emitted are caused by ionizing primary particles. The size distributions for stars caused by ionizing and nonionizing particles are given, and possible explanations for the difference between them are considered. The experimental observations are in agreement with the theory that the star-producing particles are mainly neutrons and protons secondary to the primary cosmic rays. The variation with star size of the proportion of doubly charged to singly charged particles is found, and for stars of more than six prongs is in agreement with Le Couteur's extension of the evaporation theory. A value of 0.54 is deduced for the proportion of doubly charged particles from disintegrations in the light elements of the emulsion. An increase in the proportion of lightly ionizing tracks is observed for stars of more than eight prongs, and is ascribed to the creation of mesons. (auth)

4315 A Temporary Increase in the Neutron Component of Cosmic Rays. N. Adams and H. J. J. Braddick. Phil. Mag. 41, 505-8(1950) May (Correspondence). (See also NSA 4-4316.)

This is a discussion of the interpretation of the experimental results reported by Adams in a preceding article (A Temporary Increase in the Neutron Component of Cosmic Rays, N. Adams, Phil. Mag. 41, 503(1950) May). The outstanding feature of these results was a very large increase at sea level, of neutron intensity as compared with ionizing cosmic radiation. The author ascribes this effect to charged particles with momenta between 2×10^9 ev/c and 10×10^9 ev/c, which produce mesons in the upper atmosphere, and explains how an increase in the incident flux of charged par-

ticles arriving from the sun would lead to the observed effects.

4316 A Temporary Increase in the Neutron Component of Cosmic Rays. N. Adams. Phil. Mag. 41, 503-5 (1950) May.

On November 19, 1949 increases of 43% were found in the ionizing cosmic rays measured at sea level in geomagnetic latitudes 50 and 80 deg, and an increase of 180% in the rays measured at Climax, Colorado, at an altitude of 11,000 ft. No increase was found at 11,000 ft on the equator. These increases were associated with a radio fade-out at 10:33 Greenwich mean time. The intensities indicated by a neutron recorder at the University of Manchester show a 550% increase at about 11:00 Greenwich mean time. After reaching a maximum value for the period between 11:00 and 12:00 the counting rate decreased continually with time and was still significantly above normal in the first hour of November 20. Thereafter, the hourly counting rates showed their usual statistical fluctuation.

4317 The Zenith Distribution of the Penetrating Component of Cosmic Radiation as a Function of the Altitude. André Voisin. Compt. rend. 230, 1396-8(1950) Apr. 12 (in French).

Measurements carried out at low altitudes (Meudon Observatory, 148 m) have shown that the frequency (counting rate/hr), $I(\theta)$, of the penetrating component is given by the expression $I(\theta) = I(0°) \cos^{\lambda} \theta$ where $\lambda = 2.18 \pm 0.02$, θ being the angle which the penetrating particles make with the vertical. The author has made similar measurements at the Pic du Midi (2860 m) in order to determine the effect of altitude variations on this law. Observations were carried out at angles of 0, 30, 60, and 73 deg with the vertical, and the counting rate for the total radiation and for the penetrating component at these angles is tabulated. It is concluded that the exponential constant λ at this altitude is 2.20.

4318 Dependence of the Reversal Temperature of Thermal Diffusion of Isotopes on the Mean Molecular Mass. E. W. Becker and E. Dornenburg. Naturwissenschaften 37, 165-6(1950)(Brief Report in German).

Isotope separation was carried out with a separation column filled with mixtures of $C^{12}O^{16}O^{18}$, $C^{13}O^{16}O^{16} + C^{12}O^{17}O^{18}$, and $C^{12}O^{18}O^{18}$. Thermal diffusion was found to have a change of direction at a "reversal temperature" which increases with the mean molecular mass of the gas mixture.

4319 German Bunsen Society for Physical Chemistry. Forty-eighth General Meeting Held at Wiesbaden, Oct. 13-16, 1949. Angew. Chem. 62, 121-5(1950) Mar. 7 (in German).

Among the papers presented were the following: Review of the Present State of Methods of Isotope Separation, W. Groth; Electromagnetic Methods of Separation, W. Walcher; Separation Tube Method and Chemical Exchange Process For the Separation of Isotopes, E. W. Becker; Separation of Isotopes by Distillation, P. Harteck; On the Possibility of Separating Isotopes by an Exchange of Artificial Resins, G. Dickel.

4320 German Physical Society in the British Zone. Meeting Held at Bonn, Sept. 21-25, 1949. Angew. Chem. 62, 97-8(1950) Feb. 21 (in German).

Among the papers presented was The Enrichment of C^{13} according to an Exchange Method, E. W. Becker, S. Scholz, and W. Vogell.

4321 Investigation of Isotope Exchanges of Iodine Between Sodium Iodide and Ethyl Iodide in Alcohol Solutions. M. B. Neĭman and R. V. Protsenko. Doklady Akad. Nauk S. S. S. R. 71, 327-30(1950)(in Russian).

Szilard and Chalmers (Nature 134, 462(1934)), in discussing the enrichment of I^{128}, assumed the absence of exchanges between C_2H_5I and the ion I^{*-}. Since that time, several authors have studied this reaction using various solvents and have observed an exchange between C_2H_5I and NaI^* in alcohol solutions (the latest in date is McKay, J. Am. Chem. Soc. 65, 702(1943)). However, the use of the short-lived I^{128} limited the study of the reaction kinetics to elevated temperatures. The present authors, by using a mixture of long-lived radioactive isotopes of I, extended the study to lower temperatures (the temperatures chosen were 10, 20, 30, 40, and 80°C). The alcohol solution employed contained 0.1 mole/liter of each C_2H_5I and NaI^*. The constants of the exchange velocity, as determined for each of the above temperatures, show that the reaction studied is a bimolecular one, that its activation energy is 19,000 cal/mole, and that its effective cross section is $\sim 3.10^{-8}$ cm. The velocity constants found are somewhat smaller than those given by McKay (and others); this may be due to the fact that the present authors used higher concentrations.

4322 Isotope Exchange Equilibria. H. E. Suess. P. 19-24 in FIAT Review of German Science, 1939-1946: Physical Chemistry. Klaus Clusius (senior author). Office of Military Government for Germany, Field Information Agencies Technical, 1948 (in German).

This review article discusses exchange equilibria in the systems (H_2, D_2, H_2O) and (H_2O, D_2O, H_2S), both from the experimental and theoretical standpoint, with particular reference to their importance for the methods of isotope separation. Moreover, it is shown how to estimate the position of exchange equilibria between molecules in the gaseous phase and ions in solution. 11 literature references.

4323 The Separation of ^{82}Br from Neutron-irradiated Sodium Bromate. E. Berne. J. Chem. Soc. (London) 1949, Suppl. No. 2, 338-40.

Methods for the preparation of Br^{82} by Szilard-Chalmers reaction with sodium bromate have been devised. Different methods have been used to deal with small or large amounts of sodium bromate. If large amounts are involved, a two-step separation is accomplished; the first step involves a separation by use of a nonisotopic carrier, and the activity is then separated from this by use of a very small amount of inactive bromide as carrier. Various carriers have been used for the first step, and different methods for the separation in the second step have been studied. (auth)

4324 Characteristics and Behavior of Bonded Wire Resistance Strain Gages in Thermal Coefficient of Expansion Measurements. Part I. SR-4 Paper Bonded A-7 and Bakelite Bonded AB-19 Gages. Martin R. Goodman. ORNL-706, May 31, 1950. 41p.

PHYSICS

The thermal coefficient of expansion of metals can be measured to at least $+0.1 \times 10^{-6}$ over the range 32.5 to 60.0°C by means of bonded wire resistance strain gauges. The strain gauges are found to exhibit gauge creep and zero shift. Such gauge malfunctions have to be differentiated from the performance of specimens under investigation. Methods are suggested to overcome these adverse gauge properties so as to obtain greater strain gauge stability and accuracy. 25 references. (auth)

4325 Use of an Auto-Oscillator Device for the Study of Nuclear Resonance. Robert Gabillard and Michel Soutif. Compt. Rend. 230, 1754-6(1950) May 15 (in French).

The authors have made a theoretical study of an oscillator with two coupled circuits which may be used for the determination of nuclear resonance frequencies. They derive an expression for the variations in frequency and amplitude of the oscillation as a function of variations in nuclear susceptibility.

4326 Investigations on a Magnetic Ion Source, I. J. Kistemaker and H. L. Douwes Dekker. Physica 16, 198-208(1950) Mar.

An ion source of the magnetic type has been developed, using oscillating electrons, and with the filament quite near the ion extraction hole. Space charge limited ion currents have been obtained ranging from 5 to 10 ma using extraction potentials of 6 to 15 kv. Hydrogen, helium, and nitrogen gas have been used, showing an apparent mass effect. No influence of the pressure on the extracted ion current was experienced in the pressure region from 10^{-5}-10^{-3} mm Hg. An experimental comparison between this source and the usual type has been carried out and the ion outputs show only small differences. (auth)

4327 Investigations on a Magnetic Ion Source, II. J. Kistemaker and H. L. Douwes Dekker. Physica 16, 209-20(1950) Mar.

It is shown that the electrons in a magnetic ion source (described previously in Physica 16, 198 Part I(1950)) can experience up to 48 oscillations in helium gas before being caught by the anode cylinder. This corresponds to a mean-path length of 1200 cm, and gives rise to electron and positive ion densities in the discharge of the order of $10^{10}/cm^3$. The degree of ionization is 0.1%. The influence of the pressure on the ion-production mechanism as well as the economy of the source are discussed. From 50 to 80% of the gas is used effectively for ion output of the source, and only 0.05 watt energy input/μa ion current on the target is needed. A discussion of the ion extraction mechanism explains the high ion currents in comparison with other types of ion sources. (auth)

4328 The Mass Spectrograph. Charles Cassignol and Étienne Roth. Atomes 49, 117-22(1950) Apr. (in French).

The author describes, in nontechnical language, the construction and operation of the mass spectrograph, discussing briefly the design of ion sources, accelerating electrodes and ion collectors. He then outlines some of the many applications of the mass spectrograph in industry (the petroleum industry), biology (the quantitative determination of the amount of a stable isotope, used as a tracer, in various organs), and in physics.

4329 Physical Applications of the Laplace Transformation. M. Parodi. Centre National de la Recherche Scientifique, 1948. 177p. (in French).

The first chapter of this book gives a rigorous mathematical treatment of the properties of the Laplace transformation. The next three chapters deal respectively with the use of Laplace transformation in solving ordinary and partial differential equations and in evaluating definite integrals. The fifth chapter applies the method to integral equations, and the sixth, the most advanced and original, considers the relation between Volterra's integral equation and the Laplace transformation. The final chapter is devoted to physical applications.

4330 Tables of the Confluent Hypergeometric Function $F(\frac{n}{4}, \frac{1}{2}; x)$ and Related Functions. Natl. Bur. Standards App. Math. Ser., No. 3, Jan. 21, 1949. 73p.

Seven-place tables for the confluent hypergeometric function $F(\alpha, \gamma; x)$, where $\alpha = \frac{n}{4}$, $\gamma = \frac{1}{2}$, x goes from 0 to 0.10 in steps of 0.01, and n goes from 3 to 201 in steps of 2, are presented. The functions $F(\frac{n}{4}, \frac{1}{2}; x)/\cosh \sqrt{(2n-1)x}$ (x goes from 0 to 0.10 in steps of 0.01 and n goes from 43 to 201 in steps of 2) and $[\log_e F(\frac{n}{4}, \frac{1}{2}; x)]/\sqrt{2nx}$ (x goes from 0.10 to 100 and n goes from 3 to 201 in steps of 2) are also included. The foreward to these tables points out the importance of the confluent hypergeometric function with $\gamma = \frac{1}{2}$ in the sequential t-test in statistical analysis.

4331 Tables of Sines and Cosines to Fifteen Decimal Places at Hundredths of a Degree. Natl. Bur. Standards App. Math. Ser., No. 5, May 2, 1949. 95p.

Values of sines and cosines and their derivatives were calculated at every degree to 25 places. Subtabulation was effected by means of Taylor's theorum. Functions necessary for interpolation are tabulated also.

4332 A Method for Monitoring X-rays Using Eastman Type K Film. Ellery Storm and Edwin Bemis. LA-1107, Apr. 26, 1950. 34p.

The response of Eastman type K film to x-rays, measured in roentgens, was determined using self-rectifying units, operating at peak potentials of 50, 150, 250, and 400 kv. A series of filters was used at each peak voltage, and the effective wavelength of the roentgen radiation was measured. A range of 2.07 to 0.05 A was covered, which corresponds to a range of 6 to 250 kv effective. The peak sensitivity of the film occurred at 40 kv effective, above which point the sensitivity decreased very steadily, being only slightly more sensitive to 250 kv x-rays than to γ rays of radium. A method of determining simultaneously the effective kv and the exposure in roentgens from a single film was developed, using a 0.508-mm lead filter over the film. The response of the sensitive Dupont 552 film was briefly investigated for purposes of comparison with the data of Deal et al (Am. J. Roent. 59, 731(1948)) and, in general, good agreement was obtained. (auth)

4333 An Analysis of Multiple Counter Technique for the Measurement of Radioactive Sources Independent of

PHYSICS

Geometry. Saul Hertz, Glenn E. Whitham, Allan MacLeod, Louis Hanopol, and Arthur Miller. Science 111, 576-8(1950) May 26.

The authors discuss a system of multiple Geiger-Mueller counters used for the measurement of radiations from a point source within the area bounded by the counters. On the basis of simplifying assumptions (all counters identical, efficiency of counter depends only on solid angle subtended by it, point source, etc.) theoretical expressions for the efficiency of such a system were computed. An actual apparatus of the type discussed was built and tested with a point source of known strength. It was found that the observed variations in the measurements were larger than the probable statistical fluctuations, which may have been due to the fact that the simplifying assumptions were not altogether justified.

4334 Assays of Ore Samples Using an Ionization Chamber. J. L. Horwood and C. McMahon. Can. Mining J., 71, 56-61(1950) Apr.

Several high pressure ionization chambers are described which were used for the measurement of the radioactivity of samples of uncrushed ore. They were filled to a pressure of 1100 psi with nitrogen, and finally with argon when it was established that no leaks were present. The authors conclude from their experimental results that the ionization chamber is capable of consistently reliable results within the limits imposed by cosmic radiation. A single complete calibration was found sufficient for months of use.

4335 Back-scattering of Electrons into Geiger-Mueller Counters. L. Yaffe and K. M. Justis. J. Chem. Soc. (London) 1949, Suppl. No. 2, 341-51.

The back-scattering of electrons into a Geiger-Mueller counter has been studied, and increases in counting rates determined. The effect of varying the energy of the β-emitter, the atomic number, and the mass thickness of the back-scatterer has been determined. Empirical relationships are given from which correction factors may be determined. The characteristics of the scattered radiation are shown. Suggestions are made for standardizing counting techniques. 48 references. (auth)

4336 A Comparison of Some Absolute Methods of Measuring Fast Neutron Flux. K. W. Allen, D. L. Livesey, and D. H. Wilkinson. Proc. Cambridge Phil. Soc. 46, 339-52(1950) Apr.

Four measuring instruments were exposed to a constant flux of monokinetic 2.15-Mev neutrons. The relative quantities recorded are given as follows:

Instrument	Flux
Homogeneous ionization chamber	1
Triple coincidence counter	0.95 ± 0.07
Hydrogen pressure chamber	0.95 ± 0.06
Thick-layer chamber	1.01 ± 0.05

The many sources of error and many correction factors, and the scope and advantage of the different methods, are discussed. A section is devoted to the angular distribution of D + D neutrons, the source here used.

PHYSICS

4337 Determination of Neutron Densities by the Permanganate Method. J. Erber, W. Rieder, and E. Broda. Nature 165, 810(1950) May 20 (Letter to the editor).

Manganese, as permanganate ion, is a suitable detector for slow neutrons. The bulk of the induced β-activity is found in the manganese dioxide fraction which is isolated by simple filtration. A minor and variable part of the activity remains with the permanganate fraction, i.e., in solution (retention). The authors investigated the mechanism of the Szilard-Chalmers effect in the permanganate ion by varying the conditions of irradiation. It is concluded that retention may be kept sufficiently constant for measurements of neutron densities to be reproducible within 1%. Retention was found to be independent of pH value between 2 and 7, and to increase on either side of this region. Retention also increases sharply with temperature.

4338 Discharge Mechanism of Geiger-Mueller Counters. I. The Motion of Quantity of Positive Ions. II. Experiments with a Separated Cathode Counter. III. Origin of the "Nachentladung." Hiroo Kumagai, Koichi Shimoda, Iwao Ogawa, Yasuo Torikai, and Teisuke Kodama. J. Phys. Soc. Japan 4, 39-51(1949) Jan.-Feb.

A discharge grows in such a way that an electron avalanche taking place in the neighborhood of the wire due to the primary electrons, in turn gives rise to another avalanche and so on. Thus more and more avalanches take place along the central wire, until the production is stopped by the shielding action of the accumulated ion cloud. Several experiments, especially measurements on the discharge spread along the wire, suggest that the successive induction of avalanches might be caused by the highly absorbable photons through the photo-ionization processes. These photons are produced by the preceding avalanche. After discharge growth comes to an end, the produced ions move toward the wall, so that the shielding action of the ions decreases gradually; and when the field near the wire is increased to the threshold value, the deadtime is over and the counter is again ready to discharge. Two kinds of Nachentladung seem to occur, i.e., those which are caused by photoelectrons liberated from the wall, and those caused by positive ions through certain unknown mechanism. Decisive conclusions, however, cannot be drawn until more critical experiments are performed.

4339 Fading of Nuclear Emulsions. L. Winand and L. Falla. Bull. soc. roy. sci. Liége 18, 184-9(1949) Apr.-May.

Tests were made on the rate of fading of latent images produced by visible light on four experimental nuclear emulsions and on Ilford B2 and C2 emulsions. The experimental emulsions were pure silver bromide containing 20% gelatin and differed only in duration of precipitation and time of ripening. The relative fading is greatest at the lowest densities and decreases with increasing initial density. It is greater for the B2 and C2 emulsions than for the experimental ones, and appears to increase with decreasing mean grain diameter. Comparison with the data of Faraggi and Albouy indicates that fading of the latent image produced by light is greater than that produced by ionizing particles. The authors suggest that photolytic bromine plays an important role in fading. Fading was practically eliminated by bathing C2 Plates for 5 min in 10% sodium nitrite solution before exposure.

PHYSICS

4340 The Improvement of Lens Type β Spectrographs. Pierre Grivet. Compt. rend. 230, 1652-4(1950) May 8 (in French).

The theory of focusing worked out by Siegbahn and Slatis is completed, and a double focusing β spectrograph with an appreciably increased resolving power is derived from it. (auth)

4341 The Influence of the Finite Size of Sample and Ionization Chamber on Dosage Measurements in the Immediate Neighborhood of Radium Preparations. H. A. Bomke and W. Specht. Strahlentherapie 81, 81-92 (1950)(in German).

The authors investigate the error introduced into the measurement of γ ray dosages in the immediate neighborhood of a radium preparation by the fact that the ionization chambers employed have a dimension which cannot be neglected compared to that of the preparation. A calculation was made for the case of samples with spherical and cylindrical symmetry. It showed that the error introduced by the neglect of the finite extension of the ionization chamber becomes noticeable only when the distance between the chamber and sample is smaller than the diameter of the chamber (which is assumed to be spherical). The error is largest when there is direct contact between sample and chamber, in which case the measured dose may exceed the true dose by as much as 50%.

4342 Measurement of High Flux of Slow Neutrons by the Photographic Method. Raymond Locqueneux. J. phys. radium 11, 144-52(1950) Mar. (in French).

A method for the direct determination of the flux of intense beams of slow neutrons, outlined by Cuer, utilizing the reaction between slow neutrons and the nitrogen in a photographic emulsion, has been applied in a study of neutrons produced in atomic piles. The length of the track of the proton emitted in this process has been calculated. The stopping power of the emulsions for protons of this energy has been determined and a new point on the range-energy curve has been established for Ilford C plates. The "coefficient of purity" of the beam of slow neutrons was evaluated, and a study of the spectrum of the fast neutrons was begun.

4343 Measurements on the Recovery of the Wilson Cloud Chamber. J. C. Kluyver and P. M. Endt. Physica 16, 257-68(1950) Mar.

The recovery time of an operating ("wet") cloud chamber was measured by the "search light" method of Milatz and van Heerden (Physica 13, 21(1947)). It was found to be much longer than the value calculated by Endt (Physica 14, 29, 97 (1948)) on the basis of the assumption that only heat conduction is important in the recovery process. Measurements of the temperature in the "dry" chamber (with no vapor present) after compression led to a recovery time agreeing with the calculated value. It is suggested that in the "wet" chamber the recovery is chiefly governed by the slow supply of vapor from the liquid to the gas, the vapor concentration having been lowered in the expansion period by the formation of droplets.

4344 Nuclear Scattering of Fast β-Particles in the Cloud-Chamber. Projected Form of Mott's and Other Scattering Formulae with Tables. C. O'Ceallaigh. Proc. Roy. Irish Acad. 53 A, 133-44(1950) Mar.

PHYSICS

The author transforms the differential scattering probability $P(\theta)d\theta$ of an electron in a scattering medium into $P(\theta)d\varphi$, where φ is the projection of θ on a plane at right angles to the optic axis of either of the photographic cameras in a cloud chamber, subject to the condition that the projection of the visible portion of the scattered branch of the track must exceed a certain length so that the energy of the scattered branch may be estimated by measurement of its curvature.

4345 On the Construction of Metal G-M Counters. Om Parkash. Current Sci. (India) 19, 119-20(1950) Apr.

A brief description is given of a simple copper tubing G-M counter and the steps in its construction. Filled with argon and alcohol, a typical counter had a plateau extending for 525 volts with a rise per volt of 0.04% of its average height.

4346 On the New Technique of Scintillation Counter. Part II. M. Ageno, M. Chiozzotto, and R. Querzoli. Rend. ist. super. sanità 12, 577-85(1949)(in Italian).

A similar article by the authors has appeared in Atti. accad. naz. Lincei 6, 626(1949). An abstract of this article has been published in Nuclear Science Abstracts as Abstract 4-1263.

4347 On a Phenomenon Observed with Geiger-Mueller Counters in Ultraviolet Measurement. Itaru Nonaka. J. Phys. Soc. Japan 3, 322-7(1948) Sept.-Dec.

Pulses from a weak source of ultraviolet light obtained from an incandescent lamp and having a maximum intensity at 3600 A were counted by a Geiger-Mueller counter which was filled with a mixture of argon and alcohol vapor in the ratio of 10/1 and connected to a 3 stage amplifier feeding into a 64 or 1024 scaling circuit. During continuous measurement, the counts rose from 63/min to a number which could not be counted after 120 min. Then the source was shut off and the sensitivity measured every 10 or 20 min by 5- to 15-sec "bursts" of irradiation. During this latter period, the sensitivity went down. This increase and then decrease in sensitivity was not observed using a continuous source of γ radiation. The explanation for this increased sensitivity is that the work function of the photoelectrons emitted from metals lining the counter tube (metals which have a photoelectric limit in the neighborhood of 3600 A) is lowered by the attachment of a layer of positive ions (mostly alcohol) to the cylinder walls. When the radiation ceases, positive ion attachment ceases and the positive ions are neutralized by electrons emerging from the metal through the potential barrier by the tunnel effect.

4348 Possibilities and Limitations of the Photographic Method in Nuclear Physics and Cosmic Radiation. Marietta Blau. Acta Phys. Aust. 3, 384-95(1950) (in German).

This is a historical survey of the use of photographic emulsions for the detection of elementary particles. The survey ranges from the discovery, made in 1909, of the fact that the grains of a photographic emulsion can be made developable by the passage of an α particle, to the discoveries of π and τ mesons in the cosmic radiation. The author also discusses apparatus recently built or under construction which will materially aid in the interpretation of tracks in nuclear emulsion, by facilitating grain counts and curvature measurements.

PHYSICS

4349 A Review of Geiger-Mueller and Special Counters. Atomics 1, 129-37, 153(1950) May.

This article is the second of a series outlining the essential features and uses of various Geiger-Mueller counters. Terms in general use are defined, i.e., plateau length, threshold voltage, plateau slope, operating voltage, useful life, etc., and a general description of some counters, i.e., x-ray counter, demountable counter, gas counter, proportional counter, and scintillation counter is given. An appendix lists firms manufacturing counters. 10 references.

4350 A Thermistor Temperature Recorder for Meteorological Survey. C. A. Mossman, J. Lundholm, Jr., and P. E. Brown. ORNL-556, May 17, 1950. 25p.

This paper deals with the design and construction of a temperature recorder for the range 10° to 115°F with an accuracy of 0.1°F, using a thermistor (thermally sensitive resistor) as the temperature sensitive primary element. The measuring element is for use with a captive balloon operating from ground level to 3000 ft. A thermistor was selected as the primary sensing element being best suited to the conditions of operation. The difficulties encountered with thermistors are discussed. The method of determining thermistor characteristics is detailed. The thermistors are matched to a single temperature versus resistance curve. The measuring circuit is designed to produce a linear record. The equations for the circuits are given. Construction data covering the changes to the recorder, provision for range changing, and range indication are given. The use of compensation for lead resistance is discussed. (auth)

4351 The Solution of the Integro-Differential Equations of the Diffusion of Integral Equations. Mircea Draganu. J. Math. Pure et App. 29, 141-68(1950) Apr.-June.

Halpern et al (Phys. Rev. 53, 173(1938)) have derived an integro-differential equation describing the diffusion of neutrons which cross a layer of matter. It is shown here that for the stationary case and elastic collisions, taking into account boundary conditions, the solution of this equation can be reduced to that of an integral equation of the Fredholm type. This Fredholm equation possesses a solution that can be represented by a meromorphic function. A simple approximate solution is obtained by the author.

4352 The Yields by Fast and Slow Neutrons in a Szilard-Chalmers Reaction. Engelbert Broda and Werner Rieder. J. Chem. Soc. (London) 1949, Suppl. No. 2, 356.

Permanganate crystals were irradiated with fast (1 Mev) and slow neutrons. After irradiation the crystals were dissolved in water at pH4 and the MnO_2 was separated from the solution by filtration. Although the recoil energy available for chemical reactions in the n,γ process was 10,000 ev using fast neutrons and 150 ev with slow neutrons, the yield of MnO_2 was approximately the same.

4353 Microwave Determination of the Structure of Borine Carbonyl and of the Nuclear Moments of the Stable Boron Isotopes. Walter Gordy, Harold Ring, and Anton B. Burg. Phys. Rev. 78, 512-17(1950) June 1.

This article is similar to NP-1404, an abstract of which appeared in Nuclear Science Abstracts as Abstract 4-2417.

PHYSICS

4354 On the Spin-Orbit Coupling in the Atomic Nucleus. H. Gaus. Z. Naturforsch. 4a, 721-3(1949) Dec. (Note, in German).

Models of nuclear shell structure can be understood if one assumes that there is a strong spin-orbit coupling for the motion of nucleons in the nucleus, which will lead to j-j rather than Russel-Saunders coupling. In this note it is shown how such a spin-orbit coupling can be derived from the interaction between meson field and nucleon field, as is assumed in vector meson theory.

4355 Proton Nuclear Magnetic Resonance Studies in KH_2PO_4, KH_2AsO_4, $NH_4H_2PO_4$, and $NH_4H_2AsO_4$. Roger Newman. J. Chem. Phys. 18, 669-78(1950) May.

Studies have been made of the proton magnetic resonance absorption at 30 Mc/sec in KH_2PO_4, KH_2AsO_4, $NH_4H_2PO_4$, and $NH_4H_2AsO_4$. Both line shapes and relaxation times have been measured from 87°K to 293°K. The potassium salts show closely similar magnetic resonance properties. Their relaxation times show relatively small variation in the temperature interval studied. The characteristic times derived therefrom do not obey any simple exponential law in the reciprocal temperature. Single crystals of KH_2PO_4 do not seem to show anisotropy in the relaxation time. A formula is given which relates the anisotropy of the motion of magnetic dipoles to the anisotropy of transverse local field variation. The ammonium salts show two minima in their relaxation time versus temperature curves. One minimum corresponds to a temperature at which the acid hydrogens are the most effective relaxation agent and the other to a temperature where the ammonium ion hydrogens are most effective. The line shapes are also of a composite character. This is most clearly shown below 100°K where the absorption lines appear to be superpositions of the broad NH_4 line for which that of NH_4Cl is typical and the narrow line found in KH_2PO_4 or KH_2AsO_4. Possible interpretations of the experimental results are discussed with reference to the motions of the protons in these crystals. (auth)

4356 Spins of Nuclei with an Odd Number of Protons and Neutrons. Georges J. Bene, Pierre M. Denis, and Richard C. Extermann. Arch. sci. phys. et nat. 2, 549-54(1949) Nov. 5 (in French).

The authors show how it is possible to deduce the spins of nuclei for odd N and P from neighboring nuclei for which N + P is odd. They divide the nuclei into two groups: (1) N = P (odd spin); (2) N = P (even spin). In the first group they also show how the same technique can be used to obtain magnetic moments. Diagrams are included showing the spin and magnetic moment for nuclei of even N and odd Z and the absolute value of the electric quadropole moment as a function of N. The relation of the magic numbers to $|Q|$, I and μ show up very clearly.

4357 Development of Useful Power from Nuclear Fission. C. G. Suits. Elec. Eng. 69, 523-8(1950) June.

The author discusses, in nontechnical terms, the fission process resulting from neutron capture in U^{235} and the conditions under which this process may produce a stable and continuous release of energy. He then describes the other types of reactions essential to the operation of breeder

PHYSICS

piles and possible methods for utilizing commercially the heat generated in uranium piles, treating such problems as health hazards to personnel and to the surrounding community.

4358 Nuclear Reactors in Scientific Experiments. John Cockcroft. Endeavour 9, 53-63(1950) Apr.

After a brief survey of the construction and mode of operation of nuclear reactors the author describes various experiments involving the use of nuclear reactors, including work on neutron beams, γ-ray capture, neutron reactions, and neutron life-time measurements. This is followed by a discussion of neutron diffraction and of the effect of neutron irradiation on solids.

4359 Production of Enriched Nuclear Fuel. K. H. Kingdon. Gen. Elec. Rev. 53, 11-12(1950) May.

This is a brief review of the advances that have been made in producing enriched nuclear fuel, directly and by the breeding process. The economic significance of its utilization in large-scale industrial application is pointed out.

4360 Disintegration of He^3 by Fast Neutrons. J. H. Coon. AECD-2856, Dec. 14, 1949, Decl. June 15, 1950. 25p.

The cross section for the $He^3(n,p)T$ reaction has been measured using fast neutrons over the energy range from 0.4 to 3.0 Mev. The apparatus and technique have been previously described (Coon and Nobles, Phys. Rev. 75, 1358(1949)). The observed values of the cross section drop off continuously from 0.8 to 0.5 barn over this neutron energy range. The estimated probable error is 25%. Deviations from the "1/v" law by about 50% suggest an energy level in the He^4 nucleus in the region of 22 Mev. (auth)

4361 Chemical Identity of the Sulphur Formed by the Slow Neutron Bombardment of Alkali Chlorides. U. Croatto and A. G. Maddock. J. Chem. Soc. (London) 1949, Suppl. No. 2, 351-5.

The S^{35} produced by irradiation of potassium chloride with slow neutrons is shown to be present in the crystal lattice as sulfate ion or as some highly reactive ion which gives rise to sulfate in all aqueous solutions. (auth)

4362 Determination of Cross Section for the Photodisintegration of the Deuteron. Kenichi Shinohara, Toshihiro Okada, and Susumu Morita. J. Phys. Soc. Japan 4, 77-82(1949).

To determine more accurately the cross section, σ, for the photodisintegration of the deuteron, an ionization chamber filled with D_2 and connected to a linear amplifier was used. The photoprotons liberated in the ionization chamber were counted and the intensity of the γ rays emitted by the Th C'' (Tl^{208}) used was determined. Pulses of two classes were obtained. Those of the first class had a breadth of about 2×10^{-4} sec and showed the characteristic features of heavy ionizing particles. The size of the pulses was consistent with the energy of the photoprotons as estimated from the binding energy of the deuteron, the quantum energy of the γ rays, and the sensitivity of the amplifier. Pulses of the second class had an irregular appearance and their breadth was about 10 times that of those of the first class.

PHYSICS

A mean value of σ from three sets of experiments was $17.2 \pm 1.5 \times 10^{-28}$ cm^2. This value is higher than the previous ones but agrees better with the value 15.3×10^{-28} cm^2 from the theoretical calculation of Rarita and Schwinger (Phys. Rev. 59, 436(1941)).

4363 The Evaporation Theory of Nuclear Disintegrations. K. J. LeCouteur. Proc. Phys. Soc. (London) 63A, 259-82(1950) Mar. 1.

The relationship between nuclear temperature and excitation energy is discussed, taking into account the thermal expansion of the nucleus and the effect of the neutron excess. Using these results, the evaporation theory is put into a form suitable for the treatment of highly excited nuclei. The competition between the emission of proton, neutron, deuteron, triton, and α particle is considered in detail, using Weisskopf's method of detailed balance. Detailed numerical values are calculated for the disintegrations of silver bromide observed in photographic plates. The main points of comparison with experiment are (1) the energy distribution of the evaporated particles, and (2) the ratio of emission of singly and doubly charged particles. The comparison yields information about the relationship of nuclear energy and temperature; the agreement with theory is as good as can be expected. It is necessary to assume that the Coulomb potential barrier is reduced at high excitation energies. (auth)

4364 Fifteen Years Artificial Radioactivity. Otto Hahn. Chem. Zt. 74, 3-7(1950) Jan. 5 (in German).

This is an historical survey of the production and utilization of artificial radioactivity. Dealt with in particular are the fission of heavy nuclei, chain reactions involving neutrons emitted during fission, uranium piles, the atomic bomb, and peaceful applications of atomic energy.

4365 Interaction of Fast Neutrons with the Heaviest Stable Nuclei (Bi, Pb, Tl, and Hg). Karl Lintner. Acta Phys. Aust. 3, 352-83(1950)(in German).

In absorption experiments involving the use of Ra-Be and Rn-F neutron sources, the cross sections for the absorption of fast neutrons and for the (n,2n) process were determined. The density of thermal neutrons was measured in a water tank with a boron chamber as indicator. The energy of the F-neutrons was insufficient for the initiation of (n,2n) processes. With the Rn-F source, the following absorption cross sections were found:

Element	σ (barns)	
Bi	0.06	0.04
Pb	0.04	0.03
Tl	0.22	0.06
Hg	0.25	0.03

For all elements investigated with the exception of Hg, there was an increase of the neutron intensity when the Ra-Be source was used. The author deduces from the absorption cross sections and the changes in neutron densities the following cross sections for the (n,2n) process:

PHYSICS

Element	γ (barns)
Bi	0.26 ± 0.05
Pb	0.25 ± 0.04
Tl	0.59 ± 0.07
Hg	0.07 ± 0.04

4366 (n,2n) and (γ,n) Reaction Cross Sections. Peter Jensen. Arkiv Fysik 1, 515-31(1950)(in German).

Measurements were made of the relative β yields from the product (n,2n) reaction in N^{14}, F^{19}, K^{39}, and Sc^{45}, using 18-Mev (Li + d) neutrons. The relative (n,2n) cross sections are calculated from the yields, taking the neutron spectrum and the energy dependence of the cross section given by statistical theory as a basis. Relative cross section values for the four nuclei above were found as 1, 4.3, 1.4, and 11.2, respectively. Relationships between the results and those for (γ,n) reactions found in the literature are discussed.

4367 The Neutrons Emitted in the Bombardment of ^{6}Li by Deuterons. W. M. Gibson and L. L. Green. Proc. Phys. Soc. (London) 63 A, 494-8(1950) May 1.

The neutrons from deuteron bombardment of a separated Li^6 target have been studied by the photographic plate method. The energy release for the reaction

$$Li^6 + D^2 \rightarrow Be^7 + n^1$$

has been shown to be 3.40 ± 0.05 Mev, and evidence is given for the existence of a level in Be^7 at 450 ± 60 kev. This is identified with the level at 430 kev found in work on the reaction $B^{10}(p\alpha)Be^7$. (auth)

4368 On the Binary and Ternary Photofission of Thorium 232. E. W. Titterton and T. A. Brinkley. Phil. Mag. 41, 500-3(1950) May.

Work by Titterton and Goward (1949) has shown that uranium undergoes photofission into three charged fragments. Experiments have been conducted to determine whether a similar process takes place in the photofission of thorium. Some difficulties were encountered in loading plates with Th^{232} atoms, but this was finally accomplished by means of a technique described in detail. Plates loaded by this method were irradiated with a continuous spectrum of γ rays of maximum energy 24 Mev from the (Atomic Energy Research Establishment) Synchrotron. Three irradiations, of 100, 150, and 180 r, were made and the resulting plates showed a fission density of 2.5×10^4/cc at the 150 r level. In an examination involving 2500 binary photofissions, 5 cases of ternary fission involving the emission of a long range light fragment, probably an α-particle, were observed. These events are described. A number-range curve was determined for the photofission tracks and is compared with a similar curve for tracks formed by the slow neutron fission of U^{235} in a D_1 emulsion under conditions of similar emulsion sensitivity. It appears that the energy release in the photofission of Th^{232} is smaller than that in the slow neutron fission of U^{235}. The data indicates that 124 Mev is the mean kinetic energy released in the photofission of Th^{232}.

4369 Possible Emission of the Dineutron in Fission. F. W. Fenning and F. R. Holt. Nature 165, 722 (1950) May 6 (Letter to the editor).

PHYSICS

Feather (Nature 162, 213(1948)) has suggested that, if the dineutron exists, it may be emitted in fission and therefore be present in pile radiations. Further, it is pointed out that Bi^{209} would be a suitable detector for the dineutron since, in the reaction with the dineutron, AcC^{211} would be produced. This isotope has an α activity of 2.16 min half-life, an activity readily observable in the presence of other activities produced in the irradiation. The authors have carried out two 10-min irradiations of bismuth in the Harwell pile at a point where the thermal neutron flux was about 10^{12} neutrons/cm^2/sec. In neither of the irradiations was there any evidence of actinium C activity. It is concluded that the product of flux of dineutrons at the detector, and the absorption cross section of bismuth for these particles was less than 1.5×10^{-21} sec^{-1}.

4370 The Production by the Cyclotron of Some Useful Radionuclides. John W. Irvine, Jr. J. Chem. Soc. (London) 1949, Suppl. No. 2, 356-60.

The author points out the inadequacy of the chain reactor for the production of many radionuclides, i.e., those which decay by positron emission or orbital electron capture, isotopically pure activities. Because they yield carrier-free products, deuteron reactions involving a change in atomic number are important. Also, the fast neutrons obtained by the $Be^9(d,n)B^{10}$ reaction are useful for (n,p) and (n,α) reactions in elements of high atomic number. Ten to twenty Mev deuterons produced in a cyclotron were used to obtain sodium, manganese, iron, and zinc radionuclides. The yields were calculated by a measurement of the activities induced in stacked foils under deuteron bombardment.

4371 The Reactions of High-energy Particles with Nuclei. Geoffrey Wilkinson. J. Chem. Soc. (London) 1949, Suppl. No. 2, 366-9.

The use of the new 184-in. cyclotron, which affords deuterons and α particles of much higher energy than hitherto available, has given a far more complex mixture of isotopes than the smaller cyclotrons. This has necessitated a reconsideration of the mechanisms involved in nuclear collisions since the results of low-evergy reactions cannot be extrapolated to explain those at high energy. The differences between the two energy categories are discussed and reasons for some of the unexpected behavior are suggested.

4372 Total Cross Section of C, O, Mg, Si, and S for Fast Neutrons. G. Freier, M. Fulk, E. E. Lampi, and J. H. Williams. Phys. Rev. 78, 508-12(1950) June 1.

The total cross sections of light nuclei containing an integral number of α particles was found by measuring the transmission of C, Mg, Si, S and SiO_2 samples for fast neutrons in the energy range 0.60 to 1.90 Mev and in the energy range 2.5 to 5.0 Mev. The cross sections have many resolved resonances, and the number of resonances per unit energy range increases rapidly with atomic number. (auth)

4373 Valences of Radiophosphorus Extracted from Alkaline Chlorides Irradiated with Neutrons. Roger Caillet and Pierre Süe. Compt. rend. 230, 1666-7 (1950) May 8 (in French).

Radiophosphorus formed in the chlorides of Li, Na, and K, by the reaction $Cl^{35}(n,\alpha)P^{32}$ is distributed approximately equally between the valences 5 and less than 5. The presence of water in the chlorides increases the proportion of

PHYSICS

P^{+5}. The results on P^{32} seem to be in contrast with radiosulfur, formed in these crystals also, where several writers have found only S^{+6}. (auth)

4374 On the Theory of the Acceleration of an Electron in a Magnetic Alternating Field. III. Contribution to the Theory of the Betatron. J. Picht. Optik 6, 133-144(1950) Mar. (in German). (See also NSA 4-2792; 4-3198.)

In continuation of previous work on the theory of the betatron (Optik 6, 40(1950); 6, 61(1950)) supplementary calculations are presented here on the following topics: the influence of a magnetic field assumed proportional to the time; approximate determination of the equations of the magnetic lines of force; and the approximate determination of the shape of the magnetic pole shoes.

4375 Power for Atomic Accelerators. L. A. Kilgore, J. L. Boyer, and C. S. Hague. Atomics 6, No. 3, 5-12 (1950) May-June.

A brief description is given of the magnet power supply being constructed for the Berkeley bevatron. A peak direct current of 8,333 amp at 12,000 v is to be delivered by banks of ignitrons fed by two 12-phase synchronous generators in parallel. Each generator will be carried through the power peaks, about 11 times a minute, by a motor-driven flywheel. The bunched protons are expected to attain energies as high as 6 Bev.

4376 The Energy Loss of Particles Traversing a Slab of Finite Thickness. F. H. Murray. AECD-2855, nd, Decl. June 9, 1950. 22 p.

In this memorandum an analysis is made of the energy loss of particles moving through a slab containing a mixture of some scattering material and hydrogen. The various special subjects are as follows: (1) Formulation of the problem with the Boltsmann equation. (2) Special cases with constant coefficients; the Legendre functions with the infinite set of equations satisfied by them. Two methods of derivation of formulas of Wigner type for high energy particles. (3) Equations for the scattering and energy loss due to heavy particles, with indications of a method of setting up differential equations for the solution if the cross sections are variable. (4) The method of the random walk for a slab, and the introduction of the frequency distribution of lengths of the zigzag paths traversed in a scattering medium; integral equation for the frequency distribution of the Laplace transform type. (5) A direct method of finding the energy loss formula for a mixture containing hydrogen, based on a direct determination of the path distribution function; and comparison with earlier formulas. (6) Formulas for a beam of particles entering a semi-infinite slab, with reflector present, and scattering and energy reduction by hydrogen alone.

4377 Energy Loss of Fast Charged Particles in a Completely Ionized Medium (Ionic Plasma). Application to Cosmic Radiation Traveling through Interstellar Space. Bernard Kwal. Compt. rend. 230, 1662-4 (1950) May 8 (in French).

Energy losses of charged particles traveling through matter may be divided into two classes: losses due to collisions with atomic electrons and losses due to radiative collisions with atoms. Expressions for the energy loss to atomic electrons were obtained from the formulas of Bethe and Bohr by replacing the frequency of revolution of the electrons and the average excitation energy, respectively, by the frequency of oscillation of an electron in the ionized medium (plasma) and the average potential of an electron in the plasma. The theory of the radiation losses (Bethe and Heitler, Proc. Roy. Soc. 146A, 83(1934)) as previously developed, may be taken over without change if the Debye radius is used as the radius of the Thomas-Fermi model of the atom. This quantity also appears in the treatment of losses to electrons. The energy loss/cm is tabulated for values of v/c ranging from 0.1 to 0.99995 and the values are much higher than those assumed by Fermi in his theory of the origin of cosmic rays, raising serious doubts as to the validity of this theory.

4378 On the Shielding Qualities of Different Concrete Mixtures. P. C. Gugelot and M. G. White. J. Applied Phys. 21, 369-79(1950) May.

Absorption curves for neutrons and γ radiation produced by 16-Mev protons on beryllium are measured in absorber blocks of various concrete mixtures to obtain information on their shielding properties. It is shown that a mixture of cement, scrap iron, and limonite ore is as efficient as water in slowing down and capturing neutrons and, in addition, has sufficient density ($\rho = 3.5$ g/cm^3) to be an effective absorber for γ radiation. Compared to ordinary concrete, a three-foot wall of iron and limonite concrete is superior by a factor of 280 for neutrons and by a factor of 20 for γ radiation. Boron is shown to be of little value in this type of shielding. Mechanical properties of the scrap iron-limonite concrete made entirely of limonite ore are shown to be a reasonable compromise. (auth)

4379 The Range-Energy Relation for Slow Alpha Particles and Protons in Air. H. A. Bethe. Revs. Modern. Phys. 22, 213-19(1950) Apr.

Recent accurate determinations of energies and ranges in nuclear disintegrations give fixed points on the range-energy relation for α particles around 1.5 and 2 Mev, and protons below 1Mev. These, and other evidence, show that the previous range-energy relation of Parkinson et al (Phys. Rev. 52, 75(1937)) for protons gave too high energies and the relation of Holloway and Livingston (Phys. Rev. 54, 18 (1938)) for α particles gave too low energies for the given range. The result of Jesse et al (Phys. Rev. 77, 782(1950)) that the ionization in argon is exactly proportional to the energy, makes it possible to correct the Holloway-Livingston relation. Experiments by Crenshaw (Phys. Rev. 62, 54(1942)) give the proton relation at low energies. New relations for both protons and α particles are presented which are consistent with all experimental evidence now available. (auth)

4380 A Study on the Polarization of X-rays. Hirendra Kumar Pal. Indian J. Phys. 24, 91-3, (1950) Feb.

The variations of the polarization of a heterogenous primary beam of x-rays were studied as functions of the magnitude of the generating voltage, and of the thickness of the aluminum filter through which the x-rays were transmitted. It was observed that a lowering of the applied voltage or an increase in the thickness of the filter had the effect of producing an increased polarization of the beam.

PHYSICS

4381 A Study of the Polarization-Direction Correlation of Successive Gamma-Ray Quanta. Franz Metzger and Martin Deutsch. Phys. Rev. 78, 551-8(1950) June 1.

A γ ray polarimeter utilizing Compton scattering as the analyzing process is described. Measurements of the polarization-direction correlations of the γ rays emitted in the disintegration of Sc^{46}, Co^{60}, Rh^{106}, and Cs^{134} are reported. (auth)

4382 The Effect of Radiation on the Properties of Liquids. George Antonoff. Science Counsellor 13, 55-6(1950) June.

Liquid systems irradiated with a radium source showed marked fluctuations in density over a period of months. The system investigated was water–isoamyl alcohol. The amplitude of the fluctuations in organic compounds correlated with the length of the chain in the organic compound. The author states that this is in support of the theory of aggregates proposed by him (Science Counsellor 11, (1948) Mar.), in which the principal conclusion is that vapor and liquid in equilibrium contain an equal number of particles per unit volume.

4383 Decay Systematics. Geoffrey Wilkinson. J. Chem. Soc. (London) 1949, Suppl. No. 2, 364-5.

Recent work in the laboratories at Berkeley is reviewed, and consideration of a large number of isotopes emitting α particles has enabled many of the phenomena to be correlated. In particular, the relations between α particle energy, mass number, and even-odd nature of neutron and proton number, and between half-life and energy in α decay, are investigated. (auth)

4384 Estimation of Beta-Activities from Bremsstrahlung Measurements in an Ionization Chamber. P. C. Tompkins, Leon Wish, and W. T. Burnett, Jr. Anal. Chem. 22, 672-6(1950) May.

The radioactivity of a β-emitting nuclide can be determined by using an ion chamber to measure the Bremsstrahlung radiation originating in the source and its container. The method is particularly applicable to the measurement of high intensity irradiation sources. The advantages of the method are: (1) ionization chambers have a much wider range, stability, and linearity of response than conventional Geiger-Mueller instruments; (2) the activity may be quantitated in solutions or solids, particularly those which are highly hydrated, without the necessity of chemical processing; (3) the comparison with β activities as measured in the usual way provides as additional criterion of radioactive purity. The major limitations are: (1) an extreme sensitivity to the presence of a γ emitting impurity; (2) the relatively high activities required; and (3) variations arising from an inhomogeneous composition of the source and its immediate environs. (auth)

4385 The 'External' Photoelectron Spectrum and the Intensities of the γ Rays of Thorium (B + C + C″). D. G. E. Martin and H. O. W. Richardson. Proc. Phys. Soc. (London) 63A, 223-33(1950) Mar. 1.

The spectra of the photoelectrons ejected from various targets by the γ rays of radiothorium and its decay products have been measured and the emission probabilities of the γ rays of energy 0.238, 0.277, 0.299, 0.510, 0.582, 0.726, and 0.859 Mev have been estimated. Using the known intensities of the internal conversion lines, coefficients of internal conversion have been found. The four low-energy rays seem to be magnetic dipole in character with some electric quadrupole admixture, but the strong 0.582 Mev ray of Pb^{208} is predominantly electric quadrupole. The possible spins of the nuclear levels are discussed. (auth)

4386 On the Ho^{166} Disintegration. Kai Siegbahn and Hilding Slätis. Arkiv Fysik 1, 559-62(1950).

Coincidence measurements between the continuous β-ray spectrum and conversion electrons show K, L, and M conversion electrons corresponding to a γ-ray energy of 80 kev. The L conversion coefficient is consistent with an electric quadrupole or magnetic dipole transition. The Compton and photoelectrons from a Pb radiator showed another γ line of 1.36 ± .01 Mev energy. A Fermi plot of the β spectrum showed that it could be resolved into two components, the upper limits of which were 1.84 Mev and 0.55 Mev, the abundance of the latter being about 10%. A more accurate gold γ counter showed the 0.55 Mev β ray to have an abundance of 11%.

4387 On the Internal Conversion in the M-Shell and Isomer Analysis. Makoto Tanihuji. J. Phys. Soc. Japan 4, 107-11(1949) Mar.-Apr.

Using a gauge obtained by W. Heitler (Proc. Cambridge Phil. Soc. 32, 112(1936)) and an approximation by M. H. Hebb and E. Nelson (Phys. Rev. 58, 486(1940)) to calculate the nonrelativistic transition matrix, the author calculates the electric internal conversion in the M shell for $l = 1, 2, 3, 4, 5$ and $\frac{\nu}{\gamma^2} = 1.0, 2.5, 5.0, 7.5, 10.0$, where ν is the γ-ray energy divided by mc^2 and $\gamma = \frac{Z}{137}$, Z being the atomic number. For large ν, the angular momentum is more important than the energy. For small ν, the internal conversion coefficient, α, for the K, L, and M shells are approximately equal. The experimental values of $\frac{\alpha_K}{\alpha_M}$ are about 4 times larger than the theoretical values obtained by the author. This the author attributes to the approximations made and the inaccuracy of the experiments. He concludes that the inaccuracy of experiment and theory make it unreliable to decide l values using internal conversion data.

4388 The Theory of β Activity Utilizing a Linear Combination of the Relativistic Invariants for the Interaction Hamiltonian. Sybren R. de Groot and Hendrik A. Tolhoek. Compt. rend. 230, 1510-12(1950) Apr. 24 (in French).

Using an interaction Hamiltonian consisting of a linear combination of the five Dirac invariants, the author gives an expression for the probabilities of electron and positron emission, and for the angular correlation between the emitted electron and neutrino. In the derivation of this latter expression the effect of the nuclear charge is neglected. The Gamow-Teller selection rules are used to evaluate the unknown parameters appearing in these equations, but the author also considers the limitations placed upon these parameters by the assumption that electron and positron emission are symmetric processes (if we neglect the interaction of the emitted particle with the nuclear charge.) These symmetry considerations are still valid if the meson theory of β decay is abondoned.

PHYSICS

4389 Radioactive Dysprosium Isotopes. F. D. S. Butement. Proc. Phys. Soc. (London) 63 A, 532-7(1950) May 1.

A new isotope of dysprosium, identified as Dy^{166}, has been studied. It has been shown that it is formed by thermal neutron capture in the 140-min isomer of Dy^{165}, the capture cross section being about 1200 barns. It decays with a half-life of 82 hr and is the parent of 27-hr Ho^{166}. It emits β particles, the energy of which was found by absorption in aluminum to be 0.22 Mev, and γ rays of less than 50-kev energy. Another new isotope, Dy^{159}, has been made both by slow neutron irradiation of dysprosium and by deuteron bombardment of terbium. It decays by orbital electron capture, with a half-life greater than 50 days. It will be described in a later paper. (auth)

4390 Studies of Neutron-Deficient Radioactive Isotopes. Geoffrey Wilkinson. J. Chem. Soc. (London) 1949, Suppl. No. 2, 360-3.

The technique of investigation of neutron-deficient radioactive isotopes, produced by use of a 60-in. cyclotron is described. For energies lower than those produced in the cyclotron, Ta foils are used to reduce the energy of the electron beam. Chemical separation after irradiation is effected by conventional methods of precipitation, solvent extraction, etc., except in the case of rare earths where ion exchange resin columns are used. The radiations emitted are usually of a complex nature consisting of orbital electron capture, γ radiation, internal conversion electrons, and the emission of β^+ and β^- particles. A β-ray spectrograph is used to give a rough estimate of decay schemes. Al and Pb foils are used to give an approximate knowledge of x- and γ-ray energies. Some preliminary results are reported and a correlation is made from them with respect to even and odd neutron and proton numbers.

4391 The Basis for the Electromagnetic Explanation of Universal Gravitation. Henri Varcollier. Arch. sci. phys. et nat. 2, 483-512(1949) (in French).

This article is divided into four parts: 1. The static gravitational attraction resulting from the interaction of two anisotropic electrostatic fields. 2. Gravitational attraction between two atoms in motion. The principle of the equality of action and reaction. 3. The attempt to link the magnetism of the proton with the ellipticity of its electrostatic field and comments on magnetism in general. 4. Supplementary notes on the proton and meson.

In the first part the author states that the interaction between two anisotropic electrostatic fields will yield a residual attractive interaction in addition to the individual interactions between the charged particles. By a suitable linear transformation he solves Laplace's equation for the energy between two charges giving rise to anisotropic electrostatic fields. He applies this result to two hydrogen atoms randomly oriented in space and derives an attractive force due to the interaction between the two protons in terms of the ellipticity of the field, which he states is related to a gravitational field. He calculates the value of the ellipticity in terms of the gravitational constant, the proton charge and mass. In the second part the author states that it is possible to explain the instantaneity of a gravitational field by assuming a moving charge to emit ellipsoidal waves, the source of each wave to lie in front of the charge so that the reception is synchronized with the position of the charge at the point of emission. This can be done from spherical Heaviside waves by a linear transformation of coordinates. He does this for the case of an emitter in uniform motion and then generalizes his equations for nonuniform motion. In the third part he considers a proton as being composed of many elements with a net charge $= +4.8 \times 10^{-10}$ esu and discusses the relation between the "permanent magnets" in the proton due to the motion of these elements and the ellipsoidal electrostatic field of the proton. He also suggests several experiments to verify his theories. In the fourth part he obtains the angular velocity for the particles in the proton and relates the energy of a wave of this frequency with the corresponding inertial mass given by $E = mc^2$. The mass obtained equals 293 m_0, where m_0 is the electronic mass. This is in close agreement with the mass of the π meson.

4392 An Improved Approximate Analytic Solution of the Thomas Fermi Equation for Atoms. N. H. March. Proc. Cambridge Phil. Soc. 46, part 2, 356-7(1950) Apr.

An approximate solution is derived for the Fermi-Thomas equation which is similar in form to that of Sommerfeld (Z. Phys. 78, 283(1932)), but with the constants contained in it slightly changed. This has the advantage that the radial momentum distribution becomes properly normalized. Furthermore, the mean percentage difference between the approximate solution and the exact analytical solution obtained with a differential analyzer, which amounted to 7% for Sommerfelds' solution, is here reduced to 2%.

4393 Influence of Radiation Damping on the Neutron-Proton Scattering at Relativistic Energies. D. Basu. Proc. Roy. Irish Acad. 53 A, 31-9(1950) Feb.

Using a pseudoscalar or vector meson field the interaction between a neutron and proton gives rise to a $1/r^3$ singularity and contact potentials involving δ functions. While these singularities can be removed in the low energy region, the $1/r^3$ term reappears in the relativistic region and causes the n-p scattering cross section to increase with increasing energy. This article shows that the inclusion of radiation reaction terms brings the cross section in agreement with experiment, i.e., $\sigma \sim 1/E$ (in the laboratory system). Only those energies where the Born approximation is considered valid (> 100 Mev) are treated and only the spin dependent interaction of the pseudoscalar meson field is used. At energies > 10^3 Mev the cross section for meson production becomes larger than the scattering cross section. The author points out that while agreement with experiment is reasonable, more accurate results at high energies can only be obtained when more is known about the existing types of mesons and their coupling with neutrons.

4394 Interaction between Four Half-Spin Particles and the Decay of the μ Meson. L. Michel. Proc. Phys. Soc. (London) 63 A, 514-31(1950) May 1.

The general direct coupling between four fermions is studied. It is a linear combination of the five invariants used in β-decay theory. Altering the order of the particles in the Hamiltonian changes only the coefficients of the linear combination. The formalism of charge conjugation is used with the ordinary theory or the Majorana abbreviated theory for neutral particles. This is applied to the study of the decay of the μ meson into an electron and two neutrinos.

PHYSICS

4395 On the Lamb-shift and the Ionization Energy of Helium-like Atoms. H.E.V. Hakansson. Arkiv Fysik 1, 555-7(1950).

Generalizing a nonrelativistic expression derived by Bethe (Phys. Rev. 72, 339(1947)) for the Lamb-Retherford shift of hydrogen-like atoms, the author calculates the ionization energy of helium-like atoms in the ground state. The radiative correction accounts for about one-half of the discrepancy between earlier theory and experiment. Another approximation in Bethe's expression restricts that Z $\ll$ 40. A relativistic calculation has been undertaken by the author to obtain further evidence on errors introduced when Z 40. 14 references.

4396 On Mixtures of Meson Fields. Claude Marty. Compt. rend. 230, 1508-10(1950) Apr. 24 (in French).

In a brief discussion of the Møller-Rosenfeld mixture the author remarks that relativistic effects reintroduce inadmissible singularities in the potential derived from the vector field (van Hove, Phys. Rev. 75, 1519(1949)). Since this is not true of the pseudoscalar field, the symmetric Møller-Rosenfeld theory must be considered invalid. On considering the various requirements which an acceptable meson theory must satisfy, the author concludes that the only possible mixed fields are those consisting of two meson fields with spin 0. The differential cross section for N-P collisions at 90 Mev are then calculated using various mixtures of this type, and compared with the experimental results. It is concluded that, in the Born approximation, mixtures consisting of charged or symmetric meson fields with an associated meson mass of 280, and neutral fields with mesons of arbitrary mass must be rejected. Scattering data provide a convenient test for the validity of meson theories.

4397 On the Quantization of the Metric Field and the Particle-Field Interactions. III. Systems of Particles. Antonio Giao. Compt. rend. 230, 1740-2(1950) May 15 (in French).

The author derives expressions, free of singularities, for the quantized metric tensors of a system. According to these expressions, the Newtonian field is due to the interaction of the particles while the Coulomb field is, at one and the same time, an interaction field and a field which may be attributed to each particle individually.

4398 On a System of Fields Free of Divergences of the Mass-renormalization Type. J. Rayski and J. Rzewuski. Helv. Phys. Acta 23, 287-90(1950).

It is shown that in the frame of the relativistically invariant formulation of quantum field theory there exist comparatively simple systems of fields free of divergences of the mass renormalization type (at least in the e^2-approximation). Quantum electrodynamics constitutes the main part of such closed systems of mutually compensating fields.

4399 Radiative Electron Interaction. I. H. J. Groenewold. Koninkl. Nederland. Akad. Wetenschap. Proc. 53, 414-31(1950) Apr.

The author proposes a unitary charge theory with action at a distance. The specific aim of this paper is to investigate the description by such a theory of processes which in the common dualistic theory of electric charges and the electromagnetic field are considered as typical radiative processes, such as the spontaneous and induced emission and absorption of photons, and the interference and diffraction of electromagnetic waves.

4400 Remarks Concerning the Two-Body Problem in Electrodynamics. Peter Havas. Acta Phys. Aust. 3, 342-51(1950) (in German).

It is shown by means of an example that there exist motions of pairs of different particles in a field of force such that the field produced by one of the particles can never reach the other one. Therefore, the two particles will move quite independently of each other. Furthermore, it is pointed out that various classical theories of pair production and annihilation that have been proposed, in which these phenomena are represented as one-body phenomena, cannot avoid the characteristic difficulties of the electrodynamic many-body problem.

4401 The Emanation Method. Otto Hahn. J. Chem. Soc. (London) 1949, Suppl. No. 2, 259-74.

Properties of chemical substances containing a radioactive element that forms a gas have been investigated by following the amount of gas escaping from the compounds. Rn^{220} and Rn^{222} were considered most suitable as tracers for this sort of analysis. The molecular state of various compounds, their inner surface deformations due to aging, molecular and chemical conversions, their solid state structure, etc., were investigated by this method.

4402 The Self-Diffusion of Silver and Mercury in Ag_2HgI_4. K. E. Zimen, G. Johansson, and M. Hillert. J. Chem. Soc. (London) 1949. Suppl. No. 2, 392-4.

To get a confirmation of Wagner's theory (Z. physik Chem., 34, 309, 1936) of the reaction mechanism in the system AgI-Ag_2HgI_4-HgI_2, an investigation was started of the self-diffusion coefficients of Ag and Hg in their respective iodides in Ag_2HgI_4 as a function of the temperature. Thin layers of Ag^{111} and Hg^{203} salts were allowed to diffuse into the inactive materials and the decrease in β activity due to the diffusion was noted. Results are illustrated by curves.

4403 Self-Diffusion in Some Solids. R. Lindner. J. Chem. Soc. (London) 1949, Suppl. No. 2, 395-6.

A preliminary account is given of experiments in which radioactive tracers have been used to determine self-diffusion constants. In one method, a thin active layer is allowed to diffuse into the inside of a pellet and the effective decrease in activity is measured. The layer is produced by condensation of the material which was evaporated in a vacuum or by a form of precipitation from solution. A device is illustrated for another method in which active and inactive pellets are pressed together under different conditions. This contact method fills the gap at 10^{-12} to 10^{-14} cm^2/sec hitherto existing between the α-absorption and recoil methods for measuring diffusion constants.

4404 A Study of the Heterogeneity of Active Surfaces by the Differential Isotopic Method. Part I. Active Surfaces of Metallic Nickel and of Zinc Oxide. N. P. Keĭer and S. Z. Roginskiĭ. Izvest. Akad. Nauk S.S.S.R., No. 1, 27-38(1950)(in Russian).

PHYSICS

With the aid of the authors "differential isotopic method" (Doklady Akad. Nauk S. S. S. R. 57, 157(1947)), and using labeled hydrogen and deuterium molecules, a study was made of the surfaces of catalytically active samples of metallic nickel and of zinc oxide. The heterogeneous character of the surfaces of both catalysts was proved, and it was shown that the known anomalies in the kinetics of the adsorption of hydrogen by these materials are caused by the heterogeneity of their surfaces. (auth)

4405 The Use of Radioactive Isotopes in the Study of the Diffusion of Ions in Solution. J. S. Anderson and K. Saddington. J. Chem. Soc. (London) 1949, Suppl. No. 2, 381-6.

A method is described by which the self-diffusion coefficient of an ion may be determined. It involves the preparation of two solutions which are identical except that in one of them the ion is labeled by a tracer atom. A capillary cell is charged with the active solution and immersed in the inactive liquid for a known length of time so that normal diffusion can take place. The cell contents are then transferred to a suitable tray, evaporated to dryness, and the radioactive content measured. Knowing the length of the capillary cell and the time of diffusion, the self-diffusion coefficient of the ion may be calculated. Some results for the system of tungstic acids are described by curves. (auth)

PATENTS

4406 Radioactivity Measuring Devices. John A. Simpson, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2,509,700, May 30, 1950.

The patent describes an apparatus employable for the measurement of radioactive contamination of portions of the human body such as the hand, comprising two radiation counters mounted substantially parallel and facing each other and sensitive to α radiations.

4407 Apparatus for Purifying Gases. Morris M. Brandegee (to U. S. Atomic Energy Commission). U. S. Patent 2,508,989, May 23, 1950.

An apparatus for purifying a corrosive gas comprising a container wherein the gas is purified, a liquid refrigerant bath disposed beneath the container, means for periodically raising and lowering the bath into contact with the container, and a moisture shield positioned around the container so as to form an annular channel with the upper wall of the bath to prevent the condensation of moisture on the container when the bath is removed therefrom is disclosed.

4408 Catalysts for Fluorination. George H. Cady (to U. S. Atomic Energy Commission). U. S. Patent 2,510,864, June 6, 1950.

A process is described for the production of a catalyst for fluorinating organic compounds which comprises plating a heat conducting metal with another metal which is then fluorinated to produce a surface layer of a higher valant metal fluoride.

4409 Distillation Apparatus. Dick Duffey (to the U. S. Atomic Energy Commission). U. S. Patent 2,508,234, May 16, 1950.

An apparatus for purifying alkaline earth metals by distillation, which has a baffle structure that functions effectively to remove impurities from the rising distilled vapors, is disclosed.

4410 Methods of Producing Uranium Fluorides and a Compound Produced Thereby. Paul A. Agron and Sol W. Weller (to U. S. Atomic Energy Commission). U. S. Patent 2,510,850, June 6, 1950.

A new chemical compound U_4F_{17}, tetra uranium heptadecafluoride, is produced by subjecting UF_4 to the action of UF_6 gas in a vessel containing pulverized UF_4 under certain conditions of temperature and pressure.

4411 Methods for Regenerating Antimony Pentafluoride from Spent Antimony Halides Resulting from the Fluorination of Organic Chlorides. Frederick B. Downing (to U. S. Atomic Energy Commission). U. S. Patent 2,510,872, June 6, 1950.

This patent describes regeneration of a spent catalyst by heating first with elemental chlorine and subsequently with hydrogen fluoride.

4412 Insulating Column Structure. Joseph L. McKibben (to U. S. Atomic Energy Commission). U. S. Patent 2,509,009, May 23, 1950.

This patent covers an insulating structure useful in separating bodies at widely different potentials. A plurality of annular sections of insulating material are arranged in such a manner that cold emitted electrons are prevented by the angular relationship between the surface of the sections and the electric field from bombarding the surface of the insulator.

4413 Leak Testing Device. Donnelle W. Sherwood (to U. S. Atomic Energy Commission). U. S. Patent 2,507,321, May 9, 1950.

A method for leak-testing an evacuated apparatus, comprising the steps of simultaneously measuring the pressure in the apparatus with an ionization gauge and a nonionic pressure gauge, scanning the apparatus with a jet of noncondensing gas having ionization characteristics different from those of air, and determining the magnitude of the difference in the readings of the two gauges caused by the gas is claimed in this patent.

4414 Mechanical Couplings. Lyle B. Borst (to U. S. Atomic Energy Commission). U. S. Patent 2,509,669, May 30, 1950.

A mechanical coupling is described for detachably securing together two abutting members by the use of an annular coupling member used to bind blocks such as graphite blocks.

4415 Treatment of Pitchblende Ores. Henry C. Thomas and Andrew S. Tomcufcik (to U. S. Atomic Energy Commission). U. S. Patent 2,506,945, May 9, 1950.

A process for recovering radium and uranium from pitchblende ores comprising comminuting the ore, reacting with nitric acid containing as an additive ammonium nitrate, sodium nitrate or a mixture of the two, adding sulfuric acid to the separated solution to precipitate insoluble sulfates, and separating the radium containing precipitate from the uranium-containing solution is described in this patent.

4416 Apparatus for Controlling Magnetic Fields. Harry W. Fulbright (to U. S. Atomic Energy Commission). U. S. Patent 2,507,301, May 9, 1950.

PATENTS

A magnetic field controller which functions to maintain a constant magnetic field over a long period of time is disclosed. This controller, useful with a mass spectrograph, has a compensating optical-electrical network which automatically varies the current through the windings of an electromagnet corresponding to changes in a varying magnetic field.

4417 Chemical Method for Concentrating Isotopes of Carbon. Melvin Calvin and Peter E. Yankwich (to U. S. Atomic Energy Commission). U. S. Patent 2,511,667, June 13, 1950.

A chemical method for concentrating the isotopes of carbon by means of repeated decarboxylation and synthesis of certain phthallates or malonates is described in this patent.

4418 Electric Discharge Device. William R. Baker (to U. S. Atomic Energy Commission). U. S. Patent 2,512,538, June 20, 1950.

A gaseous discharge device of large power rating having the characteristic of precisely controlled ignition time and capable of passing thousands of amperes of pulsed current is disclosed.

PATENTS

4419 Neutron Meter. Lynn H. Stauffer and Thoma M. Snyder (to U. S. Atomic Energy Commission). U. S. Patent 2,506,944, May 9, 1950.

This patent covers a neutron radiation intensity meter comprising a chamber containing a neutron-sensitive material surrounded by a moderator material with means responsive to the ionization produced by the neutron-sensitive material.

4420 Systems for Measuring Limited Current Changes. Kenneth G. MacLeish (to U. S. Atomic Energy Commission). U. S. Patent 2,510,930, June 6, 1950.

This patent covers an electrical system for measuring limited current changes wherein a given part of the current to be measured is prevented from influencing an ammeter, and the ammeter is calibrated with a current value at the beginning of the scale corresponding to the value of the suppressed current.

4421 Vacuum Tube Flux Meters. Ray Kinslow (to U. S. Atomic Energy Commission). U. S. Patent 2,509,394, May 30, 1950.

An accurate and sensitive vacuum tube flux meter is disclosed which indicates magnetic field intensity and uniformity in terms of or as a function of plate voltage.

AUTHOR INDEX

For each reference the digit preceding the dash is the volume number and digits after the dash are the abstract number.

ADAMS N
4-4315 4-4316
AGENO M
4-4346
AGRON P A
4-4410
ALBERMAN K B
4-4277
ALLEN K W
4-4336
ALPHER R A
4-4306
ANDEM M R
4-4127
ANDERSON J A
4-4202
ANDERSON J S
4-4258 4-4277 4-4405
ANTONOFF G
4-4382
ARDEN T V
4-4270 4-4273
ARMSTRONG W D
4-4196 4-4215
ARNASON T J
4-4193
ARRIVABENE G
4-4172
ARROL W J
4-4251

BAIN G W
4-4298
BAKER W R
4-4418
BALTZAN D M
4-4169
BARBOUR I
4-4308
BARTHOLOMEW M V
4-4221
BASU D
4-4393
BAUD J
4-4160
BEAVER J J
4-4234
BECKER E W
4-4318
BELANGER L F
4-4214
BEMIS E
4-4332
BENE G J
4-4356
BENEDEK T
4-4144
BERNE E
4-4323
BERVEN E
4-4161
BETHARD W F
4-4139
BETHE H A
4-4379
BETTS R H
4-4272
BILLS C W
4-4246 4-4248
BLASCO E
4-4283
BLAU M
4-4349
BLOCK R J
4-4217
BLUMGART H L
4-4163
BOLIN V S
4-4202
BOMKE H A
4-4341
BONET-MAURY P
4-4224
BORBELY F
4-4187
BORST L B
4-4414
BOUISSERES G
4-4260
BOYER J L
4-4375
BRADDICK H J J
4-4315
BRANDEGEE M M
4-4407
BREWER L
4-4284
BRINKLEY T A
4-4368
BRODA E
4-4337 4-4352
BROMLEY L A
4-4284
BROWN P E
4-4350
BURG A B
4-4353
BURNETT W T JR
4-4384
BURSTALL F H
4-4273
BUSINCO O
4-4184
BUTEMENT F D S
4-4213 4-4389
BUU HOI
4-4239

CADE S
4-4178
CADY G H
4-4406
CAILLER R
4-4273
CALVIN M
4-4417
CAMERINI U
4-4310
CASARETT G W
4-4151
CASSIGNOL C
4-4328
CASTELLAN G W
4-4275
CAUSEY G
4-4203
CAYER D
4-4194
CHAIET L
4-4250
CHIOTTI P
4-4269
CHIOZZOTTO M
4-4346
CHRISTENSON C W
4-4141 4-4257
CLUSIUS K
4-4322
COCKCROFT J
4-4358
COLLINS C J
4-4155
CONDON F E
4-4233
CONNICK R E
4-4261
COOK G B
4-4227
COOKE W D
4-4268
COON J H
4-4360
COOR T
4-4301
COPELAND M M
4-4171
COPP D H
4-4198 4-4199 4-4200
CORNATZER W E
4-4194
COUGHLIN J P
4-4295
COWING R F
4-4205
CRAWFORD J N B
4-4146
CROATTO U
4-4361
CRONKITE E P
4-4153
CROSS H C
4-4293
CUBICCIOTTI D
4-4296
CULLEN G
4-4215

DAANE A H
4-4269
DACEY J R
4-4238
DAVIDSON N
4-4278
DAVIES C E
4-4167
DAVIS R H
4-4249
DE AMICIS E
4-4205
DE BRUYN P L
4-4299
DE GROOT S R
4-4388
DEKKER H L D
4-4326 4-4327
DELANEY J C
4-4291
DENIS P M
4-4356
DEUTSCH M
4-4381
DE VRIESE R
4-4131
DEYE R W M
4-4258
DIECKMANN C
4-4135
DITTRICH W
4-4135
DONIACH I
4-4195
DONTSOVA E I
4-4285
DORNENBURG E
4-4318
DOWNING F B
4-4411
DRAGANU M
4-4351
DUDLEY H C
4-4190
DUFFEY D
4-4409
DUNCAN J F
4-4227

EASTMAN E D
4-4284
EHRLICH P
4-4228
EICHLER A
4-4263
ENDT P M
4-4343
ERBER J
4-4337
ERICKSON C A
4-4145
ETTINGER M B
4-4257
EUGSTER J
4-4307
EVANS G R
4-4313
EXTERMANN R C
4-4356

FALLA L
4-4339
FENNING F W
4-4369
FERNANDEZ J M S
4-4156
FINE J
4-4219